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60. ELeRS: A Framework For Scoping E-Learning Research In Healthcare

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Abstract

In recent years, e-learning has tremendously increased the opportunities for different approaches to learning for both individuals and groups, made possible via ICT. Increasingly, universities and institutions are harnessing the capabilities of e-learning and other innovative technological systems to facilitate the education and training of healthcare providers, students, patients/clients, and the public at large. Equally, the continuing education of practicing health professionals through sharing experiences and ideas with colleagues is made possible via access to such ICT facilities. However, although we have progressed much in terms of providing accessibility to health information through the rapid growth of the Internet, the success of e-learning in healthcare comes in isolated areas. This is partly due to the nature and complexity of the health industry which involves a huge number of stakeholders, and the rapidly evolving technology. In addition, the lack of progress may also be partially explained by the lack of a proper structure to guide and scope e-learning research within the complicated health setting. In this paper, we argue the usefulness of a functional framework of e-learning research in the healthcare area. Therefore our aim is not to provide another e-learning literature review. By examining the extensive e-learning literature, with particular focus in the health sector, we propose a user-centered and context-sensitive approach to e-learning research, using a framework modified and adopted from stakeholder theory. The different components of this framework are presented. Future work includes an evaluation of this framework.

Keywords: e-learning, health, health information, information systems, research, education

Introduction

The Internet provides a great opportunity for online access to information, and therefore greatly facilitates learning by trained workers, students and the general population of all ages. In healthcare, where general practitioners, hospital doctors, nurses, and health centers were the main sources of health information reported in the 1990s (Buckland 1994), e-learning has tremendously increased the opportunities for different approaches to learning over a wide variety of media, made possible via ICT. Moreover, learning can be tailored to different needs and levels of e-learning users. The overall objective of e-learning in the health industry is to facilitate or enhance learning, overcoming barriers in terms of time, space, and more, so as to improve the healthcare of population at all levels, via the use of appropriate ICT, notably telecommunication infrastructure and communication software.

The benefits of e-learning for health workers are particularly evident in poor rural areas where there is a serious shortage of health workers; e-learning allows staff to upgrade their skills at anticipated quiet times, without having to leave their workplace. Other benefits include the ability to gain easy (24/7) access to learning resources/training, cost effectiveness of training, the ability to meet regulatory and compliance requirements for accreditation purposes (Anonymous 2001), more flexible study patterns for continuing professional development (Brittain and Norris 2000). Ultimately e-learning is important for the education of all stakeholders and the management of patients.

The literature for e-learning has been reviewed in terms of its barriers and solutions from managers, trainers, and learners viewpoints (Childs et al. 2006). The problems posed in e-learning are complex, involving numerous stakeholders, agencies, and can span across regional, national and international organizations. Moreover, health e-learning systems utilize many different technologies (e.g. E-surveillance (Broder 2003), virtual reality (Gallagher and Cates 2004)) and infrastructure, and they facilitate the learning of many different areas of health (e.g. occupational medicine (Kolb et al. 2007), nursing education (Yu et al. 2006; Glen 2005), and virtual community of practice for healthcare students (Moule 2006; Clarke et al.).

Although we have progressed much especially in developed countries and also in terms of providing accessibility to health information especially for developed countries, success comes in isolated areas. There is no framework to place piecemeal efforts, so progress in this area also cannot be easily traced. We believe health e-learning research should not be viewed as projects within isolated disciplines, as is common in the past. The lack of progress may be partially explained by the lack of a proper structure for undertaking e-learning research within the complicated healthcare setting. Moreover, due to the overwhelming quantity of literature published in vastly different outlets, there has been no integrative view of how research in this area could proceed in a systematic way. Our aim is not to provide another e-learning literature review. However, we need to develop an understanding of the overall scope of the health information systems domain in order to proceed. Therefore we examined extensive literature from diverse multidisciplinary outlets (major journals from medicine (medical specialties), medicine education, learning, education, information systems, medical informatics) using keywords to focus on "e-learning" in the "health sector", such as health e-learning, learning in health, health distance learning, health education, health information systems, healthcare systems, medical information systems, and health in developing countries.

This paper will employ a broad definition of e-learning: "instructional content or learning experiences delivered or enabled by electronic technology". (cited in (Gallaher 2002), (IsoDynamic 2001)). We propose a user-centred and context-sensitive approach to scoping healthcare e-learning research. User categories identified support healthcare initiatives which consistently appeared in a large number of papers (e.g. evidence-based medicine, lifelong learning). The context of healthcare e-learning research would be systematically evaluated via a number of pre-defined components. We suggest that healthcare e-learning should be viewed in the broadest sense (both in terms of users and context), with a view to include (rather than exclude) relevant research, and ultimately to progress healthcare e-learning practice and research at a global level. Section 2 describes the framework, section 3 describes common issues raised, we conclude with a summary of our work including future work.

A Framework for Scoping E-learning Research

In this paper, we suggest that e-learning research in healthcare can proceed using a user-centred and context-sensitive approach. Not all stakeholders are users of health information systems, some may participate in a given act or action, but are not users within that given context or time period (McLeod and Clark 2007). In e-learning, users are stakeholders who interact directly with the system which facilitates the e-learning, and non-users, are the remaining persons or entities who have a stake in the final outcome of the system implementation (e.g. donors and sponsors of the systems, institutions and agencies who have an interest in promoting global health). E-learning users may range from healthcare professionals and students to ordinary lay persons, who have different literacy and computer skills. E-learning systems exist for learning, education, and/or training as a high level goal. However, it can be supported by many different types of technology and infrastructure (e.g.,

it maybe a bespoke software system or off-the shelf, synchronous or asynchronous, etc), and each system is constructed with different user requirements in mind which may vary in scope and time frame.

Our review of the literature revealed the breadth of knowledge required to understand the field of e-learning in healthcare (e.g. learning and teaching, adult education, medical education, medicine, health policy, health informatics, information technology/systems, knowledge management, etc). A practical guideline for starting a research is identifying one or more keywords or short phrases that can point you toward potentially useful resources (Leedy and Ormrod 2005). The objective is to develop a research proposal beginning with a thorough literature review in one or more areas (Webster and Watson 2002). A prime source of these keywords is the statement of research problem. It is therefore important to frame or formulate a clear research problem statement, from which further research questions can be clearly expressed (Berg 2001). Researchers are however cautioned to clearly and specifically articulate research problems, since a lack of clarity and specificity may lead to ambiguous findings that can be interpreted in contradictory ways (Frankfort-Nachmias and Nachmias 1996). However the literature does not offer practical guidance on how to achieve the first step in defining a clear problem statement, especially when the 'relevant' literature space is potentially very large and the literature sources span across so many different disciplines, this task can become very daunting and discouraging. Without guidance, the researcher risks eliminating important contextual information that is crucial in determining, shaping and refining the direction of research. In the complex healthcare setting, individuals, groups, societies, and nations can potentially have great impact on the use of health-related information systems. It is important that research approaches a particular e-learning topic with a balanced (macro-micro) focus. In fact, researchers have argued (Agarwal and Lucas 2005) for more information systems research with a greater macro focus. Because of this, we felt that a novice researcher in this field could benefit from guidance in developing research focus in this area. We adopted the framework derived and modified from stakeholder analysis (Varvasovszky and Brugha 2000) because of the coverage, simplicity and clarity in its defined components. The original framework was intended to give guidance for policy planning, analysis, development and implementation in the health area. Some minor adjustments were made to customize to the e-learning context, including component renaming, deletion of 'Users' as a component (but to highlight criticality of users in e-learning research, we incorporated different user types as another dimension in the framework), and tailoring of component definitions to suit our purpose.

Analyzing E-Learning Users

Due to the wide array of different e-learning users who have different background and motivations for e-learning, it is necessary to present our scoping framework according to broad categories of e-learning users. The framework subdivides all stakeholders into three main categories of e-learning users (health professionals/trainees, communities and individuals), and a final category ('E-learning Hybrids') to capture the collaborative proclivity of different stakeholders within the healthcare practice setting.

We define healthcare e-learning users to be those persons who use ICT individually or as a group/community for healthcare purposes, with learning and/or education as foremost goals. As with (McLeod and Clark 2007), we only include e-learning users who interact directly with computer systems. Sometimes, the boundary between different reasons for interaction and communication is not clear cut in which case researchers should consider which perspective they wish to focus on.

E-Learning for Health Professionals, Trainees, and Researchers

This category facilitates lifelong learning and continuing education of practising health professionals, and formal learning for obtaining professional accreditation for healthcare trainees. Healthcare professionals require lengthy, specialized and rigorous training. They need to engage in lifelong learning, to keep up to date with latest medical research and development. For them, learning may involve the use of e-learning and other innovative systems (such as Telemedicine which connects dispersed health care facilities via videoconferencing, telecommunication, and digital networks to perform long distance

medical diagnoses). E-learning allows access to special cases not available locally, as well as traditional and online resources such as journals, magazines, Open Educational Resources (OER) (Petrides and Jimes 2006), or medical repositories. The use of technologies for teaching and learning is not without its own set of issues. Major concerns include standards (e.g. electronic storage of patient information), and ethical issues (e.g. privacy, confidentiality, and security (Raghupathi and Tan 2002)). Misuse of patient information could lead to lawsuits, discouragement from using IT, and reluctance from consumers to share personal medical information.

E-Learning for Communities

E-learning for communities exists for the purpose of assisting, supporting family, friends and communities of specific interest. These people may or may not be health professionals, they engage in virtual communities and electronic support groups to share experiences, ask questions, or provide emotional and self-help (Eysenbach et al. 2004). For example, e-learning can support different communities (e.g. people with learning disabilities in an e-learning environment (Williams et al. 2007), young people with type 1 diabetes using chat line (Iafusco et al. 2000), and cancer patients in virtual communities for cancer support (Landro 1999)).

E-Learning for Individuals

There is increasing awareness about individuals' own health as a result of better educated populations, medical (online) resources (e.g. online portals of health insurance companies, online newspapers), and the promotion of patient-centre care. These resources provide general educational health materials (including information about chronic illnesses), preventative measures to avoid illnesses, as well as guidelines/tips to promote healthy lifestyles. Traditionally, such advice would come mainly from the medical practitioners. However, increasing awareness means such information is becoming increasingly available on the Internet as well as other paper-based outlets. This category addresses e-learning for individual consumers who demand health information for managing themselves, or for assisting, supporting family, friends and the local community. The use of web-based personal health records for personal health information management (cited in (Pratt et al. 2006)) supports this initiative.

E-Learning Hybrids

The above categories of learning are not mutually exclusive. In fact, e-learning research can span across different user categories to facilitate different e-learning needs which may be provided by a combination of technologies. For example PHRs can be used by both individuals and health professionals, in learning about patient's health history and determining best treatment for patients. Individuals may also learn through a combination of sources - in virtual communities, online medical resources, and health professionals. This is particularly critical for continuing medical education, where medical information (ideally scientifically proven) can be seamlessly incorporated and integrated into practitioners' workflow (Godin et al. 1999). The flexibility of combining technologies and different user types is important because it reflects the complexity of the e-health context, the limitation of a single technology and importance of communication and sharing in achieving e-learning outcomes. This supports the increasing emphasis on collaboration between different parties (e.g. physicians-specialists, physicians-patients). This last user category therefore captures the interdependent relationships and communications between a set of stakeholders from any of the previous categories. These would facilitate e-learning in a team setting, most notably in clinical practice or in a teaching environment.

Components of the E-Learning Research Scoping (ELeRS) Framework

Our scoping framework is defined by the following components:

1. **Purpose** of the e-learning system/technology – describes the different purposes of the system from the *user's viewpoint* (e.g. from a student's perspective, the purpose could be managing their learning and assessing their performance). This component gives

- researcher some understanding about the users' high level expectations of the system being studied.
2. **Context** of the e-learning study – describes the high level setting the research could be carried out. It also helps to identify the main contextual factors of the study, including managerial, administrative, cultural, political, organizational, etc influences which may impact on the study outcome (e.g. education of healthcare workers in a developing country from a management perspective). Consideration of context helps to explain complex situations, failures/successes of technological innovations (Avgerou 2001).
 3. **Resources** – describes (a) technological resources (not necessarily be a specialized-learning application), (b) human resources, and (c) organizations/agencies which support the e-learning environment being studied. Technological resource requirements are the necessary hardware and software to fulfill users' purposes. Description of resources includes key functionalities of the systems and the IT infrastructure. Human resources are non-users who are responsible for the development, implementation, and administration of the e-learning systems. Although they are not direct users of the systems, they may also impact the ultimate success or failure of the system. Organizations/agencies are the initiators, sponsors, policy makers, accreditors, and regulators of e-learning systems. They provide the implementation structure and support for the e-learning environment. This component triggers issues arising from the management of limited monetary and human resources to fulfill the desired e-learning objectives (e.g. outsourcing, finance, system integration, system maintenance and administration).
 4. **Level** of analysis – local (L), regional (R), national (N), international (I) - determines the level of the study which influences the research procedures (e.g. data collection and analysis). Particularly, the scope and the level of generalization and theorizing will be affected by the chosen level (unit) of analysis (Frankfort-Nachmias and Nachmias 1996). The healthcare setting can be particularly varied depending on the level of analysis. Remote or rural regions typically have many resource constraints that impact e-learning capabilities. Furthermore, the health literature recognizes the need for multilevel health programmes. This component considers the appropriateness of different research methods and helps plan the research to provide the mix/level of micro/macro focus intended, as well as defining comparative studies within a chosen level of analysis (e.g. comparing the adoption of e-learning in regional (R) healthcare centers of developing countries).
 5. **Issues** – we have introduced this component to highlight specific issues/topics relevant to the defined context. Issues help scope the research further by considering the overlap between topics of interest to the researcher as well as the gap in the literature. For a researcher novice in e-learning and/or e-health research, an analysis of issues often require some preliminary review of the research literature.

Based on our review of literature and our experiences with e-learning, we believe the framework can assist researchers determine the scope of their e-learning study. By analyzing its components, researcher can pinpoint what is included, and more importantly what is excluded from the study; research boundaries are made explicit upfront. In this way, a study's limitations can be clarified at the beginning rather than at the end, and therefore researcher can better plan, design and control the study. For example, if conducting a comparative study, the framework could help identify and control the key components, and the variable(s) being studied. Also, families of studies can be designed to ensure good coverage of a variety of critical issues, leading to a more integrated research program.

The ELeRS framework is intended to help scope a research study, develop research problem statement and high level research questions, and clarify potential research contributions, by considering the components in the framework. Existing literature (Leedy and Ormrod 2005; Kumar 2005) provides little or no guidance for scoping research. ELeRS is however not intended to help develop full research proposals. As well, our framework lends itself to the development and evaluation of e-learning programs (i.e. evaluation research). A mapping of completed e-learning research using the ELeRS framework's e-learning user categories would assist with understanding the current status of e-learning research, including the identification of gaps in the literature.

Table 1 presents an outline of the ELeRS framework, including examples of the framework components for the three main categories of e-learning users, to illustrate the

example conditions under which these e-learners participate in e-learning. In addition, for each framework component, we also present the research implications which show how the component analysis contributes to the research process. The last user category is not included simply due to the variety of different user types that can be combined in studies.

Common Issues for E-Learning Research

A number of common research issues need to be addressed regardless of the setting/environment, technologies, and stakeholders of the e-learning context. Researchers may choose to study e-learning with a particular perspective selected from these common issues. The first issue relates to the **quality of the health information**. Depending on the context of e-learning, the criticality of the quality of the health information may vary. For example, we may expect that if the quality of health information shared on virtual communities is not high as expected (e.g. e-learning users use sharing as a social support outlet, and thus correctness of information can still be checked with health professionals) that this may not be as critical as sharing between health professionals in learning about new diseases. In the case of e-learning for the continuing education of health professionals, the quality of health information for e-learning users would be critical, as the information learnt will be subsequently applied in actual health settings, and mistakes made as a result of erroneous or inaccurate information can result in fatal and litigious outcomes.

The second issue relates to the **cultivation of learning culture and its effects on IT adoption and diffusion**. While the design and delivery of e-learning technologies and their supporting infrastructure are important, equally important are the human, social and organizational dimensions of using ICT. Cultural factors are major barriers to successful adoption of IT systems (Bates and Gawande 2003). Other factors that have been addressed include the adoption rates of users (Woodel and Garofoli, 2003), the individual and social aspects of learning (Salomon and Perkins 1998), workflow optimization (Halgard 2004), cost and incentives (Bates and Gawande 2003), standardization (Bates and Gawande 2003) and integration of different technological platforms. It is essential to adopt a holistic or socio-technical approach to implementing technology-enhanced learning (Rainsford and Murphy 2005).

The third issue relates to **special needs of developing countries**. Developing countries have very different needs from developed countries due to the large number of constraints (e.g. resource poor (Singler and Farmer 2002)) they face. It is commonly known that health information systems (including e-learning initiatives) are unsustainable; this may be a problem of a lack of the cultivation and institutionalization of a new kind of culture (Kimaro and Nhampossa 2005). Moreover, previous e-learning research results conducted in developed countries are not immediately generalizable to developing countries. In fact, there is evidence that alongside successes, many information systems in developing countries can be categorized as failing either partially or totally (Heeks 2002).

A number of initiatives are directly conducive for catering to the needs of developing countries. For example, 'Open Education Resources have gained increased attention for their potential to obviate demographic, economic, and geographic educational boundaries—in short, for their ability to serve as an equitable and accessible alternative to the rising costs and increased commercialization and privatization of education.' (Petrides and Jimes 2006) Success depends on the sustainability of such undertakings, therefore use and reuse research of OER would be very beneficial.

Conclusion

Globally, healthcare e-learning is an important initiative. It helps to promote health equity (Braveman 2002), reduce digital divide, meet the special needs of underdeveloped countries like Africa (Secretary-General 2001), to name a few. The education of healthcare workers is critical due to the severe shortage and exits of healthcare workers worldwide, especially workers from sub-Saharan Africa and other developing countries (Chen et al. 2006).

Table 1. The ELERS framework for scoping healthcare e-learning research (component examples and research implications are shown)

Framework Component	Categories of E-Learning Users in Healthcare (Examples of Framework Component for the three main categories of e-learning users are presented)			Implications of framework component to research
	Health professionals, trainees and researchers	Communities	Individuals	
Purpose	<ul style="list-style-type: none"> • Transmit electronic medical information (patients' personal details, medical histories, medical results including images, charts, etc). • Facilitate ((a)synchronous, ad hoc, regular, or on-demand) communication with any stakeholder. • Store, search, and retrieve medical information including up-to-date medical research, health alerts and any other news. 	<ul style="list-style-type: none"> • Share health information with others who have a similar interest. • Provide and receive emotional support and counsel from other community members. 	<p>Record personal health information</p> <p>Inform public individuals about health and wellbeing.</p>	<p>Indicates e-learning user's expectations and acceptance of the technology supporting e-learning.</p>
Context	<p>Learning for any health workers who engage in:</p> <ul style="list-style-type: none"> • Professional qualification and student training • Continuing in-service education and training • Curriculum development and teaching • Developing improved ways of undertaking in e-health research. 	<p>Informal learning about health through sharing with the community</p>	<p>Learning for any individual about health issues, including personal conditions and general health promotion.</p>	<ul style="list-style-type: none"> • Indicates the key focus of the research study and therefore the high-level setting in which research will be conducted. • Indicates sources of research data available to researcher. • Indicates possible research approaches by considering options for data collection , high-level research constructs)
Resources	<ul style="list-style-type: none"> • Bespoke or off-the-shelf systems, 	<p>Virtual</p>	<p>Health websites or</p>	<ul style="list-style-type: none"> • Indicates possible issues relating to the management and

	<p>communication technologies</p> <ul style="list-style-type: none"> • (Non-)IT staff (programmers, researchers) • Senior administrators (funding bodies) 	<p>communities, electronic support related resources or portals.</p>	<p>any other health-related resources</p>	<p>allocation of resources which may impact e-learning outcome.</p>
Level of analysis	L, R, N, I (See * below)	L, R, N, I	L, R, N, I	<ul style="list-style-type: none"> • Indicates research boundaries. • Indicates research (external) validity.
Issues	<p>Cost, time, access, convenience, trust, reliability, accuracy, security, computer literacy, information quality, copyright, ethics, information subscription, pedagogy, recognition of training at (inter)national levels, motivations for learning, workflow, organizational culture, human behavior and other such socio-technical issues</p>	<p>Trust, reasons for sharing, socializing</p>	<p>Usability, computer skill/literacy, confidentiality, privacy, security, ethics</p>	<ul style="list-style-type: none"> • Indicates key topics that are relevant for the defined context. Topics help pinpoint theories of relevance and interest to researchers. E.g. social ecological theory is relevant for consideration of social-environmental factors.(Chappell et al. 2005) • Indicates possible sources of literature to be reviewed. • Identify research collaborators that will be able to contribute to chosen topics.

* local (L), regional (R), national (N), international (I)

E-learning research in the area of healthcare spans a very large scope in terms of contextual settings, users, as well as technologies. Researchers in this area may come from many diverse areas (e.g. health informatics, medicine, learning, education, information systems), many of whom usually publish within their own disciplines and have little experience in collaboration with researchers from related disciplines within the healthcare e-learning area. In this paper, we suggest that further guidance using a context-sensitive and user-centered approach to e-learning research is necessary to move the area forward. We argue that e-learning research should understand who the e-learning users are, and what their expectations are of the e-learning systems since healthcare represents a markedly different social and technical context compared with many other industries (Chiasson and Davidson 2004). To do so would require a deep understanding of the context within which it is embedded (Avgerou 2001), as well as the context in which health professionals, trainees, and administrators undertake their tasks.

By focusing research on people (especially e-learning users) and the context in which e-learning is undertaken, diverse and/or mixed research methodologies may be employed to provide different perspectives of the research problem. In addition, collaboration amongst researchers from different but related disciplinary areas (such as medicine, medical librarianship, health informatics, information systems, knowledge management) is critical in gaining a more integrated and holistic perspective of e-learning research.

We have identified three broad categories of e-learning users in healthcare which support the trends which place increasing emphasis on the direction of healthcare practice and research (e.g. patient-centered medicine, lifelong learning, evidence-based medicine); the last category allows studies to focus on a mixture of users which is particularly critical for practicing professionals who work in teams and require continuous education. We also suggest a theoretical framework that assists researchers define the scope of their research. By analyzing the components of the ELeRS framework, families of e-learning programs can be developed and investigated by varying selected component attributes (e.g. context, issues). In this way, we hope to improve overall coverage of research in the health e-learning domain.

Further evaluation of the proposed framework is required to deepen our understanding of the current status of e-learning in healthcare, including the identification of fruitful lines of research that have not been investigated. Concerted and systematic effort and leadership is required through cross-fertilization of researchers and practitioners from multiple disciplines.

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