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Abstract

Healthcare is a large, complex industry, involving many stakeholders, involving issues at individual, organizational, inter-organizational, and/or international levels. The ELeRS framework was recently formulated to help scope e-learning research in the healthcare industry. In this paper, we describe some practical guidelines to assist researchers use this framework. These guidelines assist researchers to either formulate an independent research study or a series of related studies, using the defined framework. A summary of the framework is first presented, followed by the guidelines, and then a concrete example of how it can be applied. Our experience shows ELeRS systematize the scoping of new research in e-learning. Some lessons learnt are discussed also.

Keywords

e-learning, healthcare, health information, information systems, research, education

1. 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.

Land et al (2007) defined a framework for scoping e-learning research in healthcare (ELeRS). They argued the need to scope e-learning research due to the vast scope of the area which spans across many disciplines. Without a framework, there is no integrative view of how research in this area could proceed in a systematic way. They employ a broad definition of e-learning: "instructional content or learning experiences delivered or enabled by electronic technology". (cited in (Gallaher 2002), (IsoDynamic 2001)). The proposed ELeRS is a user-centred and context-sensitive approach to scoping healthcare e-learning research (Land et. al 2007). 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 continue the development of ELeRS in this paper by developing a set of practical guidelines (Section 3) for analyzing the components in ELeRS, as well as describing the process using which ELeRS can be applied (Section 4). Section 2 summarises the framework defined by (Land et. al 2007). In Section 4.1, we illustrate the application of ELeRS using a concrete example and discusses out experience in Section 4.2. Section 5 concludes with some limitations and suggestions for future work.

2. Summary of ELeRS - A Framework for Scoping E-learning Research

Land et al. (2007) 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. 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.

Land et.al. (2007) argue the lack of practical guidance on how to achieve the first step in defining a clear problem statement. This is 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. They then 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.

The following are the categories of e-learning users defined in ELeRS:

1. E-Learning for Health Professionals, Trainees, and Researchers (HPTR)

This category facilitates lifelong learning and continuing education of practising health professionals, and formal learning for obtaining professional accreditation for healthcare trainees.

2. E-Learning for Health Communities (HC)

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).

3. E-Learning for Health Individual Consumers (HIC)

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. 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.

4. 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. 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.

The ELeRS framework is defined by the following components (Land et. al 2007):

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).

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).

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.

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).

5. **Issues** – this component highlights specific issues/topics relevant to the defined context.

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, the research implications which show how the component analysis contributes to the research process are also discussed. The last user category is not included simply due to the variety of different user types that can be combined in studies.

3. Guidelines for Applying ELeRS

ELeRS consists of five components. To apply ELeRS, every component can be analysed and multiple studies can be formulated by varying one or more component(s) of the framework, while keeping other components constant. However, without a clear understanding of the literature, this may generate duplicate studies with no clear overall objective. We believe that studies are best triggered from topic(s) of interest in the real world and/or identified gaps in the research community. It is important to note that ELeRS is not intended to *directly* assist with the final implementation and adoption of the e-learning system. As mentioned, its purpose is to help scope e-learning research. However, well scoped research can assist with a better understanding of the needs of the e-learners and can indirectly contribute to the adoption and implementation of the e-learning system. In this section, we formulate some practical guidelines for applying ELeRS.

Guideline 1:

*The **purpose** of technologies should focus on areas which supports e-learning.*

At a lower level, it includes functions to store, search, and retrieve information or educational materials. At a higher level, it includes the ability of the technologies to facilitate, and enhance learning. Where the technologies do not exhibit any functions which support e-learning functions, it will indicate that existing technologies are not supporting of e-learning activities and that e-learning research may likely take the form of e-learning implementations.

Guideline 2:

The context in which e-learning is undertaken should clearly explain the environment and constraints in which e-learners face.

For example, is e-learning conducted for trainees in healthcare, or continuing education for qualified professionals? Trainees are likely to be more outcome focused – they must successfully complete necessary qualifications in order to be qualified or accredited for practice. While they may engage in some practice, the extent of their practice may be deliberately restricted, and furthermore they may only work under the supervision of qualified counterparts. Qualified professionals have necessary credentials and experience to practice their profession, and generally hold more responsibilities. However, amidst their busy working life, continuing education is often challenging due to existing work commitment. Nevertheless, it is critical to keep themselves up to date with latest knowledge and development in their profession. Continuing education may or may not be compulsory for accrediting bodies but in the healthcare industry, relevant training is definitely beneficial for practice. Successful e-learning must take into account the diverse contexts of different e-learners. this will help researchers understand how to best tailor e-learning activities to the study context.

Table 1: The ELeRS framework for scoping healthcare e-learning research (component examples and research implications are shown) (Land et. al 2007)

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 (HPTR)	**Health Communities (HC)**	**Health Individual Consumers (HIC)**	
Purpose	• 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.	• Share health information with others who have a similar interest. • Provide and receive emotional support and counsel from other community members.	Record personal health information Inform public individuals about health and wellbeing.	Indicates e-learning user's expectations and acceptance of the technology supporting e-learning.
Context	Learning for any health workers who engage in: • Professional qualification and student training • Continuing in-service education and training • Curriculum development and teaching • Developing improved ways of undertaking in e-health research.	Informal learning about health through sharing with the community	Learning for any individual about health issues, including personal conditions and general health promotion.	• 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	• Bespoke or off-the-shelf systems, communication technologies • (Non-)IT staff (programmers, researchers) • Senior administrators (funding bodies)	Virtual communities, electronic support groups, discussion forums, blogs, wikis	Health websites or any other health-related resources or portals.	• Indicates possible issues relating to the management and allocation of resources which may impact e-learning outcome.
Level of analysis	L, R, N, I (See * below)	L, R, N, I	L, R, N, I	• Indicates research boundaries. • Indicates research (external) validity.
Issues	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	Trust, reasons for sharing, socializing	Usability, computer skill/literacy, confidentiality, privacy, security, ethics	• 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)

Guideline 3

Resource availability and constraints must be clearly understood.

Learning is a generally a resource intensive activity and therefore has serious cost and time implications. Extensive training, in particular, takes participants away from their normal duties while undertaking training, although some other training can be incorporated within the workflow of e-learners (e.g. using clinical decision support). Appropriate technologies can facilitate training by providing e-learning capabilities. Resource analysis must include both technological as well as non-technological components.

Guideline 4

Begin each study with one level of analysis first to enable a deeper understanding of the e-learning issue(s).

Once completed, other levels of analysis help to increasingly build on our initial understanding. Determining the level(s) of analysis of the research helps to scope and focus the research of interest. Decisions on level of analysis also dictate the choice of theories used and how research is designed and executed.

Guideline 5

The consideration of multiple diverse issues per study reduces the depth of each study, whilst good coverage of diverse issues provides a more global overview of the research problem.

While the identification of issue(s) is a useful mechanism to trigger research, and to bring to attention relevant literature possibly spanning across different disciplines, there is a need to scope initial investigations by giving priorities to one or more issues of crucial importance, controversial or contentious, arising from the literature or in healthcare practice.

4. An Example of Applying ELeRS

To illustrate how ELeRS can be applied, we chose a Sydney-based aged care organization. We give an overview of the case first, followed by an analysis using the ELeRS framework, and then conclude with a description of one or more potential studies derived from the analysis. The process to apply the ELeRS is shown in Figure 1.
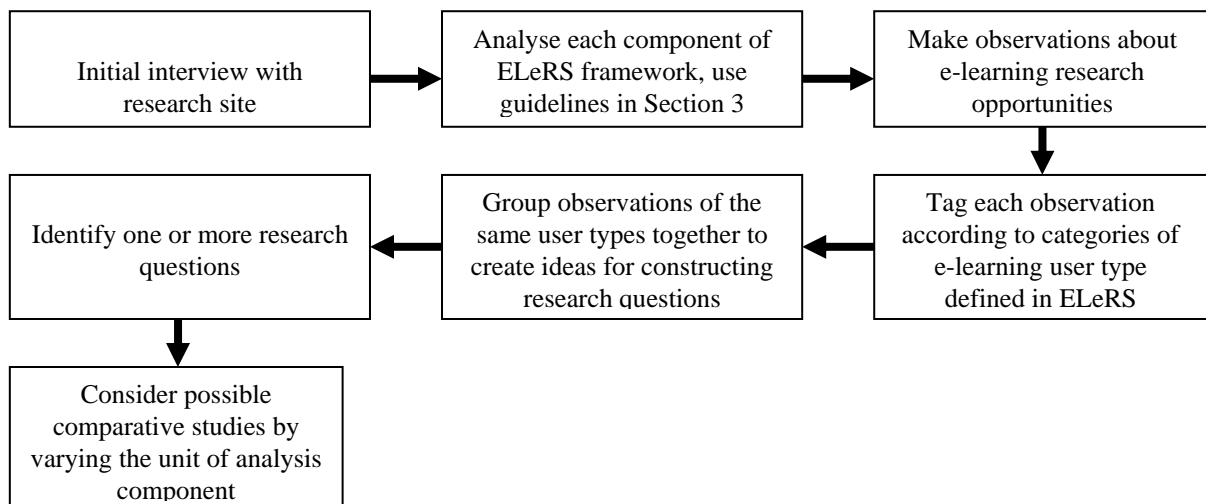
Figure 1: Process for Applying ELeRS

4.1 Generating E-Learning Research in Aged Care

The analysis presented in Table 2 draws from data collected from an initial visit to an aged care organization based in Sydney. The organization is non-profit based, but it is run like a typical business because employees need to be paid. Aged care differs from nursing homes in that residents in the former are more able to care for themselves than those in nursing homes. Each resident in this aged care is categorized on an 8 point rating scale, depending on extent of care required. The organization is geographically separated into 4 different locations and consists of 140 beds, but centrally managed from one headquarter.

Table 2: Analysis of E-Learning in Aged Care

ELeRS component	Analysis of ELeRS component	Researchers' observations about e-learning opportunities, triggered from the component analysis
Purpose	• To store aged residents admission, financial and clinical care information. • To search and retrieve the above information for the care and management of aged residents. • To train and facilitate the training of residents and aged care staff.	• Training requirements can be identified from the day to day • operation of the aged care organization, as well as from records of residents' and staff's personal details. (HPTR-1)
Context	An Aged Care Service Organization in Sydney, consisting of four hostels separated geographically.	• Facilitation and ease of communication between hostels required, rather than relying on gut feeling and good will of staff. (HC-1) • Traceable communication will facilitate future audits. (HPTR-2, HC-2)
Resource	Technological resource: 1. EPICOR – software application to facilitate the above purposes. 2. Moving on training 3. Aged care Channel Non-technological resource: 1. Training instructors from diverse sources.	No customized in-house e-learning platform. Training is mostly outsourced (may be held in-house). A combination of learning modes available with differential costs. (HPTR-3) Relative benefits or barriers to e-learners (staff, trainees, residents) and to organization are unclear.(HPTR-4, HIC-1)) Trainees have diverse needs. Manual planning and scheduling of training can be time consuming. (HPTR-5)
Level of Analysis	Global aged care, Australian Aged Care (National Level), NSW Regional Aged Care (State Level), Individual Aged Care Operation (Business Level), Staff/trainee/resident	Availability of site access critical. 3-6 levels currently available.
Issues	Accreditation of aged care service Reputation of care Education of staff and residents – planning and cost.	• 44 expected outcomes required for accreditation for aged care practice. Violations of accreditation items can have dire consequences – closure in the worst case, or loss of reputation and confidence. (HPTR-6, HC-3) • Education and training is important for staff, aged care trainees, and residents. Each of them have differing and evolving needs. (HPTR-7, HC-4, HIC-2)

The overall purpose of this analysis is to propose one or more research from the e-learning perspective. In the analysis (Table 2), researcher can insert observations about e-learning opportunities triggered by the component analysis and tag each as a unique observation classified under a particular e-learning user type previously defined in Table 1 (e.g. HPTR-1 is researchers' observation relevant for the e-learning of "Health Professionals, Trainees and Researchers"). The proposed research studies for our example are illustrated below.

Study 1:

What information is required to strategize training for all stakeholders in aged care, and what are the current challenges for acquiring these information? (HPTR-1, HPTR-5, HPTR-7, HC-1, HC-2, HC-4, HIC-1, HIC-2)

Study 1 attempts to study the overall learning needs of the aged care organization. The researchers observation tags show this study can be studied from all e-learner's perspectives, as well as from e-learning hybrid perspective. Study 1a addresses a crucial requirement for aged homes to operate. *'Accreditation is about ensuring aged care facilities meet a set of Accreditation Standards, set by the Commonwealth Government. Specially qualified aged care assessors visit a home and speak with staff, management, residents and their families, to determine whether the home meets all the Accreditation Standards and expected outcomes. The Agency then makes a decision about how long a home is accredited. Most homes, if they meet all requirements, receive three years' accreditation. A home* **must** *be accredited by the Agency in order to receive funding from the Australian Government. Even after a home receives accreditation, the Agency continues to monitor homes to ensure residents continue to receive a high level of care and that all standards continue to be met.'* (Aged Care Agency).

Study 1a: What are the learning requirements to facilitate smooth accreditation (and benchmarking) of aged care organizations? (HPTR-2, HPTR-6, HPTR-7, HC-1, HC-2, HC-3, HIC-2)

Therefore Study 1a is a legitimate related study on its own, and logically it should be undertaken after Study 1. It should evaluate current status of the organization on existing practices in four key areas: (1) Management systems, staffing and organisational development, (2) Health and personal care, (3) Resident lifestyle, and (4) Physical environment and safe systems. The evaluation should help benchmark the performance of the aged care organization; and furthermore also make recommendations on how accreditation can best be achieved via training and education. In particular, the evaluation should also suggest how technology can facilitate the process; and recommend a number measures to improve the accreditation pathway. As with Study 1, researchers' observation tags show that Study 1a can be studied from all e-learner's perspectives, as well as from e-learning hybrid perspective.

Study 2:

What are the relative benefits of different modes of training from the perspective of staff and residents? E.g. face-to-face, video channels, online courses (HPTR-3, HPTR-4, HIC-1)

Study 2 compares different types of training – ranging from traditional face-to-face medium to online medium, by drawing on different stakeholders' viewpoints. Researchers' tags show that current modes of learning in that Aged Care Organization does not include online group learning (i.e. no HC tags), which may be a viable option of learning.

So far, the studies above have been proposed for a particular aged care organization, the unit of analysis is individual level (staff, trainee, and resident). Depending on access to research sites, the scope can be increased to include business, state, country, and global levels. Therefore, quite different studies can be proposed when unit of analysis varies. Comparisons are possible, across states/regions and countries. For example, we can compare the e-learning strategies among the different states in Australia (unit of analysis is state level), or compare aged care performance of Australia with other countries (unit of analysis is national level).

4.2 Lessons Learnt from Applying ELeRS

It is important to note that components in ELeRS are for analyzing *existing status* of the study contexts, that is, they are not for expressing requirements for future resources. However, researchers' observations may trigger studies which may lead to recommendations for new e-learning solutions. Therefore, ELeRS can also be seen as a framework for evaluating the e-learning needs of the contexts concerned.

Our example application of ELeRS, triggered by availability and access to a particular aged care organization in Sydney, used data from an initial interview to analyze the framework components. This interview was largely unstructured. The intent was for the researchers to understand the aged care domain and how the organization works, so that we could explore possible areas of collaboration with the organization. Equally, it was an opportunity for the organization to get to know the researchers. Subsequently, the organization is expecting a more formal articulation of research proposals. We therefore found the ELeRS framework quite useful for

systematizing and scoping e-learning research. In fact, the five components of the framework are generic elements of research especially in domains which are user-centered and context-sensitive. When tabulating the component analysis against the specific user types which are tailored to e-learning in healthcare, ELeRS provides a structure to help researchers scope e-learning research.

ELeRS has a limited scope of use in that the user dimension is tailored to users of e-learning in healthcare which may not be suitable to other domains of study.

5. 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).

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. Land et al (2007) defined and argued the importance of ELeRS – a framework for scoping e-learning research in healthcare. However, no practical guidance was provided as to how ELeRS could be practically applied. The contributions of this paper are:

1. A set of practical guidelines for analyzing the components of ELeRS (Section 3),

2. A practical process description of how ELeRS can be applied (Section 4, Figure 1) using the guidelines and the e-learning user types defined by (Land et. al 2007) , in order to generate research studies, and

3. A concrete example of applying ELeRS.

There is potential for ELeRS to be used as a generic framework for scoping research in other domains. However, more tailoring is required, for example in the e-learning user categories and guidelines. In the aged care organization where ELeRS was applied in this paper, we were able to readily extract information from the organization to carry out the analysis. Where information is not readily available (for example where information is located and distributed in (multiple) rural/remote sites), the process described in this paper is not readily applicable. More work is required on the framework to tailor to such situations.

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