Effective e-learning for health professionals and students—barriers and their solutions. A systematic review of the literature—findings from the HeXL project

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Abstract

Introduction: In 2003/4 the Information Management Research Institute, Northumbria University, conducted a research project to identify the barriers to e-learning for health professionals and students. The project also established possible ways to overcome these barriers. The North of England Workforce Development Confederation funded the project.

Methodology: The project comprised a systematic review of the literature on barriers to and solutions/critical success factors for e-learning in the health field. Fifty-seven references were suitable for analysis. This review was supplemented by a questionnaire survey of learners and an interview study of learning providers to ensure that data identified from the literature were grounded in reality.

Results: The main barriers are: requirement for change; costs; poorly designed packages; inadequate technology; lack of skills; need for a component of face-to-face teaching; time intensive nature of e-learning; computer anxiety.

A range of solutions can solve these barriers. The main solutions are: standardization; strategies; funding; integration of e-learning into the curriculum; blended teaching; user friendly packages; access to technology; skills training; support; employers paying e-learning costs; dedicated work time for e-learning.

Conclusions: The authors argue that librarians can play an important role in e-learning: providing support and support materials; teaching information skills; managing and providing access to online information resources; producing their own e-learning packages; assisting in the development of other packages.

Background

An essential component of the delivery of the National Health Service (NHS) Plan is a well-developed, educated and competent workforce. 'Working Together—Learning Together',[1] the national learning strategy, admits that this is a challenging and complex task. There is intense pressure to maintain the service, ensuring that training is relevant for the purpose, and flexible enough to take account of different learning styles. Both the national learning strategy and the now-superseded NHS University (NHSU) identified e-learning as a central strategic delivery mechanism.[1,2] The role of strategic advice and direction for

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learning in the NHS has now been taken over by the NHS Institute for Innovation and Improvement (http://www.institute.nhs.uk/).

Most UK universities are also investing in e-learning for all different student categories, including health. In recent years, e-learning has become a high profile approach for pre-registration health students and for continuing professional development (CPD) needs of NHS staff. Despite e-learning's high profile, e-learning is not straightforward and very often raises many issues. Research suggests a number of key issues and questions that need to be considered. E-learning may be more effective as a combination (or blending) with traditional class-room based learning. The level of personal support required, e.g. through e-tutors, has been frequently underestimated. How will the role of current and future trainers change? What information communication and technology (ICT) infrastructure is required to support e-learning? What organizational policies and processes are needed? Do the barriers differ, depending on the individual's profession or roles in the NHS? There is a pressing need to understand these issues and establish how they can be addressed.

E-learning strategies covering the different educational sectors have recently been published. The Department for Education and Skills (DfES) strategy, 'Harnessing Technology: Transforming Learning and Children's Services'[3] provides a joined up approach across schools, colleges, universities and adult and community learning organizations. Its four objectives comprise:

'Transform teaching, learning and help to improve outcomes for children and young people, through shared ideas, more exciting lessons and online help for professionals,

'Engage "hard to reach" learners, with special needs support, more motivating ways of learning, and more choice about how and where to learn,

'Build an open accessible system, with more information and services online for parents and carers, children, young people, adult learners and employers; and more cross-organization collaboration to improve personalized support and choice,

'Achieve greater efficiency and effectiveness, with online research, access to shared ideas and lesson plans, improved systems and processes in children's services, shared procurement and easier administration.'

The Higher Education Funding Council for England (HEFCE) has also recently published its 10-year e-learning strategy for universities and colleges.[4] This strategy was developed in parallel with the DfES strategy. HEFCE's strategy aims:

'to support the HE sector as it moves towards embedding e-learning appropriately, using technology to transform higher education into a more student-focused and flexible system, as part of lifelong learning for all who can benefit.'

Its objectives are:

'To enable institutions to meet the needs of learners and their own aspirations for development,

'To support institutions in the strategic planning, change management and process development that are necessary to underpin their development and embedding of e-learning,

'To promote learning research, innovation and development that begin with a focus on student learning rather than on developments in technology per se, enabling students to learn through and be supported by technology,

'To support lifelong learning by joining up our strategy with those of other sectors of education, enabling connections between academic learning and experiential learning in the workplace and other aspects of life.'

The NHSU, as well as promoting the development of 5- year local e-learning strategies in NHS organizations (e.g. Delivering E-Learning in the NHS. Getting the Blend Right. A Strategic Approach for the North-West[5]), also worked towards developing a national e-learning strategy for the NHS. A discussion paper[6] and on-line consultation on this paper[7] have been produced. The NHSU's website (at the time of writing this article) stated:

'The national vision for e-learning in the NHS is to enable staff to access learning opportunities at times and places that best fit in with their lifestyle. This means 24-h access to knowledge and learning resources, 365 days per year, from places that are most convenient for individuals and groups, with the technical support structures to ensure this happens … NHSU is working with the SHAs [Strategic Health Authorities] to develop a shared strategy for e-learning across the whole of the NHS. The strategy will embrace e-learning, knowledge management and network technology, and provide local guidance to help bring coherence to the many initiatives already underway across the NHS. The strategy will create a clear and practical framework for the development and delivery of e-learning which can be adapted to meet regional and local needs. It will also provide a context for NHSU partners and stakeholders including the Department of Health, NHS Trusts, national agencies, suppliers and professional bodies to develop their own strategies.'

The higher education Joint Information Systems Committee (JISC) is currently funding an e-learning development programme (http://www.jisc.ac.uk/index.cfm?name = programme_elearning) focusing on: e-learning and pedagogy; e-learning frameworks and tools; e-learning and innovation; distributed e-learning. A range of individual projects have been funded to explore these issues.

Introduction to the HeXL Project

The overall aim of the HeXL project (Health eXL: Surmounting the barriers to NHS e-learning in the North-East) was to identify barriers to effective e-learning and the processes to overcome these barriers for NHS staff and healthcare students in the North-East of England. The Northern England NHS Workforce Development Confederation (now part of the Northumberland Tyne & Wear Strategic Health Authority) provided the funding for the Information Management Research Institute [now the Information Society Research Community (I-SRC) at the School of Computing, Engineering and Information Sciences], Northumbria University to carry out the study. The project was directed and advised by a Steering Group. This Steering Group was chaired by the Workforce Learning Development Manager of the Northern England Workforce Development Confederation. Members comprised training staff from local NHS trusts, university staff and representatives from the NHSU. The project ran from May 2003 to March 2004. The project data files are freely available on the project website (http://www.healthexl.co.uk).

Methodology

The project used a range of qualitative approaches to data collection, comprising a systematic literature review, semi-structured phone interviews and a questionnaire survey. The use of this range of methods allowed for triangulation of the data. The prime focus was the exploration of barriers, and their possible solutions, to e-learning for NHS staff and healthcare students. The findings from the systematic literature review will be widely applicable. The interviews and questionnaires produced qualitative data, which are not generalizable. However, the NHS and higher education setting in the North-East is broadly similar to the rest of the UK, and there would seem to be no reason why these findings could not provide pointers to others.

The systematic literature review was conducted using methods promulgated by the Centre for Reviews and Dissemination[8] but adapted to the particular demands of this project. The databases searched comprised: AMED (allied and alternative medicine); ASSIA (applied social sciences); Cinahl (nursing and allied health); ERIC (education); HMIC (health management); LISA (library and information science); PUBMED (Medline); Web of Science (Social Science Citation Index). The search strategy used the search phrases 'e-learning' or 'computer assisted instruction', limited by the terms 'health' and 'barriers'. The bibliographies of selected articles were also assessed for relevant items. Overall restrictions were that articles should be written in English and be published no earlier than 1997. In summary a total of 142 references were obtained through these various search strategies. A further 19 references (mainly grey literature) were added from a separate search of the report literature and relevant websites, making a total reference pool of 161 references. Fifty-seven

of the references were deemed suitable to be included in the final analysis templates. The subject content was the main criterion for selection, i.e. articles that discussed barriers to and solutions/critical success factors for e-learning in the health field. Study type was not an absolute criterion. Articles describing research on barriers/solutions were included: all types of research design were considered applicable. However, if an article was a 'substantial' discussion of the issue from an expert viewpoint or from a review of the literature than this was also included. The bibliographic references were managed using EndNote.

The selected references were analysed in two stages. First, appropriate content was extracted from the individual articles using a standard template with the following categories:

- EndNote code
- Publication year
- Document type
- Methodology/analysis details
- Geographical location
- Professional grouping
- Provider
- Project time span
- E-learning subject
- Type of activity
- Barriers/Challenges/Issues
- Solutions/Critical success factors
- Memorable quote

Second, information on barriers and solutions were further summarized in the form of grids as follows:

- By staff category
  - Provider/Manager
  - Trainer/Deliverer/Academic (note: the term trainer is used throughout this article)
  - User/Student/Learner (note: the term learner is used throughout this article).
- Then by issue
  - EndNote Code
  - Organizational Issues
  - Economics
  - Hardware
  - Software
  - Support
  - Pedagogical Issues
  - Psychological Issues
  - Skills
- Then by context
  - Clinical
  - Higher education
  - Other

A number of quality control procedures were inbuilt into the systematic literature review: double checking by two team members of article references considered to be suitable for inclusion; a sample of initial analysis templates cross-checked against the article by another team member to ensure consistency and reproducibility; secondary analysis grids cross-checked by two team members against the original article. It is harder to conduct a full, rigorous systematic literature review when the topic under study is difficult to define by specific, distinctive search terms and covers qualitative research and non-research publications. We have inbuilt as many of the objective processes of this methodology as is feasible, and therefore feel justified in describing our work as a systematic literature review.

The aim of the interviews and questionnaires was to ensure that the barriers and solutions identified from the systematic literature review were grounded in reality. The phone interviews aimed to obtain the views of managers and trainers. Thirteen interviews were undertaken. The questionnaire survey aimed to obtain the views of users/non-users of e-learning. One hundred and forty-nine questionnaires were returned.

The questions in the interviews and questionnaire were based on the findings from the systematic literature review. The interview schedule, in summary, comprised the following questions:

1. Briefly, what is your work role?
2. What involvement do you have with e-learning?
3. How would you define e-learning?
4. Have the necessary changes occurred to implement e-learning?
5. Is e-learning effective?
6. Is e-learning time-effective?
7. Does e-learning support the variety of students' learning styles?
8. Are e-learning packages appropriate and well-designed?
9. Do all the players have the necessary skills?
10. Is the technology appropriate, available, reliable?
11. Is e-learning cost-effective?
12. Are there any more barriers from your viewpoint?
13. The following solutions have been suggested—what do you think of them?

14 Any there any more solutions from your viewpoint.
15 Any other comments?

The questionnaire, in summary, comprised the following questions:

1 Your organization details
2 Your professional details
3 Your study details
4 Briefly, how would you define e-learning?
5 Your views on e-learning *
6 Your views on time and e-learning *
7 Your preferred learning style *
8 Your views on the design of e-learning material *
9 Your views on the skills required for e-learning *
10 Your views on the technology needed for e-learning *
11 Your views on the costs of e-learning *
12 Briefly, do you have any other comments about e-learning issues?
13 The following things would improve my e-learning *
14 Briefly, would anything else help improve your e-learning?

In the questions marked * the respondent was asked to tick one of the options 'I strongly agree', 'I agree', 'I disagree' or 'I strongly disagree', to every statement in a list of statements.

Systematic literature review results

The findings are organized under each of the issues covered in the data extraction template, i.e. organizational issues, economics, hardware, software, support, pedagogical issues, psychological issues, skills. For each issue, first the barriers are described, followed by the solutions.

Organizational issues—barriers and solutions

Organizational barriers are clearly of concern to managers. Integration across the national and local levels is lacking.[9] Undertaking e-learning requires change and management of this change is poor, with organizational inertia and staff resistance.[10,11] Barriers occur with programme development and implementation. Adopting and developing e-learning programmes is time consuming.[12] Quality standards are lacking.[13] Modules need to be carefully scheduled[11] and marketing can be problematic as it can be difficult to convey the benefits to potential learners.[14] Package development is also problematic with lack of competition between suppliers[13] and technical and time demands on developers.[15] There are internal staffing difficulties with trainers lacking the time or skills to develop e-learning material.[14,16] Facilities also need to be appropriately organized.[17] Concerns about negative effects on patient care have been raised, both in terms of managing additional tasks and of interference in the doctor–patient relationship.[18] Trainers also have concerns about the process of change[10,19] their lack of involvement in e-learning developments[20] and poor communication with IT staff.[10] Lack of time is of great concern. Time is needed to develop e-learning programmes and to evaluate material but no dedicated time for this purpose is made available.[10,11,21–23] Trainers also have workload concerns.[21] Learners also have concerns about time; the time consuming nature of e-learning, and how to manage their time appropriately.[21,24–30] Module scheduling and opening hours of facilities were inappropriate.[11,24,30] Practical issues were also of concern, e.g. child care, geographical location, transport, staff shortages, and inappropriate facilities.[17,24,28] Learners needed advice on organizing e-learning tasks.[31]

At managerial level a wide range of solutions were identified. There should be a national approach and support, e.g. a national accreditation body[9,32] and national and local standards and guidelines.[9,18,33] A strong commitment is needed from the institution and the trainers[34,35] with a culture shift[36,37] strategies, planning and processes for implementation[10,17,37,38] and appropriate resource management.[37] E-learning needs to be integrated into all aspects of the institution and into the curriculum[17,35,37] with co-operation between departments and between software providers and trainers.[17] Skilled staff are needed[17,32] with systematic procedures and incentives for obtaining trainers' input.[17,18,34] From a more altruistic viewpoint there is a need for open access packages[39] and packages in foreign languages.[40] At the trainer level there needs to be collaboration between content, pedagogy and technology.[41] Incentives for trainers are needed.[17] Trainers need time to master the technology, to convert materials and to prepare teaching sessions.[19,42] A crucial issue is that information or

content obtained from patients must be with informed consent.[39] Learners need flexible e-learning that can suit their individual work-life balance; flexibility in programmes, study methods and access to trainers.[24,43–46]

Economics—barriers and solutions

For managers economic issues can be significant barriers. There is a need for cost effectiveness/cost benefit evidence.[16–18] E-learning has a wide range of associated costs: hardware costs, e.g. start up costs, providing sufficient equipment, and then the ongoing costs of keeping this equipment up to date;[12,13,17,18,34,37,47] software costs, particularly for licenses;[12,13,17,20,34,47] programme development costs;[14,20] costs of training and development of trainers;[12,13,17,48] costs of buildings and materials;[17,21,48] hardware and software support costs.[37] Trainers were concerned that the costs of e-learning would increase class sizes.[49] Their involvement in e-learning could be constrained by lack of grants for materials and expenses.[21] Learners were concerned about the costs of courses[24,26] and of associated requirements such as computers, internet access and printing.[43,50,51] This could cause inequitable access for those who lacked the necessary money.[24,25,43,50] If learners are required to pay these levels of costs then sufficient materials need to be provided to justify them.[20]

At a managerial level, the main solution is evidence for the true costs of e-learning and associated cost-effectiveness and cost benefits. In contrast, the solution for learners is cheap or free courses and materials[24,39] although paying up front may make the learner become more involved in the outcome of the programme.[52]

Hardware—barriers and solutions

From a managerial viewpoint, the hardware is in the earlier stages and insufficient for the task.[13,18,38] There is a lack of information about hardware[17] and transportability and compatibility can be a problem.[17,18] As mentioned above, costs of hardware are a significant barrier.[12,13,17,18,34,37,47] There is a lack of computer hardware for trainers.[20,33] The technology available can be inappropriate or not used to its full potential[18,53] and there can be technical problems.[29,52,54] A major concern for learners is lack of, or inadequate, technology at both work and home, e.g. computers, printers, applications, internet access, access speed.[10,21,22,27,33,38,43,50,51,55,56] Technology can be poorly designed[18] with transportability and compatibility problems.[17,42] Learners also experience technical and practical problems with hardware.[29,30,57]

At a managerial level, a national approach would be beneficial, e.g. delivery channels and broadband strategy.[9] Appropriate location of equipment is necessary.[13] Equipment needs to be future proofed.[15] Trainers need easy access to equipment[25] and they need to be comfortable with it;[27] suggestions on effective use of specific items of hardware should be available.[46] Hardware needs to be reliable[39] and technological problems need to be solved quickly.[42] Similar solutions are relevant to learners: easy access to computers, including from home;[25,58] being comfortable with the hardware;[27] reliable equipment.[39]

Software—barriers and solutions

Similar problems are experienced with software as with hardware. From a managerial viewpoint, software is in the earlier stages and insufficient for the task[13,34,40,57] there is a lack of availability of good software[9,17,34] and a lack of information.[17] Transportability and compatibility is a problem.[17] Costs, particularly for software licenses, can be a significant barrier.[12,13,17,20,34,47] Lack of trainers' time for evaluating course software or developing materials is another barrier.[10,12] Trainers find that software packages are of poor quality.[18] They are also concerned that they are not involved in the selection, evaluation or development of materials.[10,17,20,59] Learners lack access to required software and to the Internet at both work and home.[10,17,21,24,27,43] Design of software can be problem[40,60] as can its currency[20] and transportability and compatibility.[17,20] The Internet can be disappointing in terms of the difficulty of finding relevant material and the poor quality of the content.[27] Once again for learners, the cost of software is a problem.[17]

Managers need to consider generalized solutions of developing content[33] with a combination of in house program development and improved feedback between software providers and trainers.[17]

Evaluation research on software packages is needed.[17] Use of an intranet rather than the Internet has several advantages.[61] Trainers need to be comfortable with the software.[27] They need to be able to preview and evaluate the software.[17,40,41] It is also important that the learner is comfortable with the software.[27] Software needs to be carefully designed from the user viewpoint and easy to use.[36,60] User piloting and feedback are crucial.[40,41]

Support—barriers and solutions

From a managerial viewpoint there is a lack of technical support staff[10,13,21,37] a lack of suitable support materials[10] and hardware and software support can be costly.[37] Trainers also lack support, both technical and administrative.[10,17,21,49] There is a limited awareness of available support material, or recognition of its usefulness in the curriculum.[38] Learners lack support from their managers for their personal development.[24] They also need support from their trainer[35,38,50] and could lack feedback.[21] Technical support is also lacking.[17,37]

Managers need to ensure that there is support for trainers and learners[18,35,52] with ongoing technical support[27] and quick solutions to technological problems.[42] Administrative support is required[37] and access to technical expertise, e.g. graphics experts.[15,46] Trainers need to provide support for learners, with deployment of different staff resources (facilitator, technician, instructor) as required.[46] Trainers need to provide learners with information and guidance[25,38] and feedback.[39,53]

Pedagogical issues—barriers and solutions

From a managerial viewpoint, e-learning packages are of poor quality and inappropriate or insufficient for the task.[12,14,34,48] Obtaining trainer involvement in and acceptance of e-learning can be a problem.[14,17,38,43] Trainers need information and guidance.[10,38] Trainers can be reluctant to adopt new systems that disrupt established practices, and can be sceptical of their benefits.[18] There is resistance to the need for change in teaching methods, with unclear messages from management and a lack of guidance or good practice.[19,23,32,38,50,51,55,56,59,61] Trainers find that packages are of poor quality, inappropriate or insufficient for the task with a lack of standards and they lack information about packages and the time to evaluate them.[10,14,17,18,33,38,48,59] There are a number of myths about e-learning which act as barriers to its adoption and affect the way it is used in practice. According to one author[62] these myths include: it is a passing fad; it is only for knowledge acquisition; it is ineffective and inefficient; 'the lonely learner'; 'the redundant teacher'; 'technology is king'; 'an unrealistic dream'. Another author[36] covers the psychological myths of e-learning: it is just another method of delivery; it is less effective than traditional methods; it takes the same time as traditional methods; it cannot cope with different types of learner; it is demotivating; it is not engaging; it provides too fragmented a learning experience; it lacks realism; it lacks retentive qualities. Trainers do see lack of interactivity and lack of personal contact as barriers[21,29,33] as well as marketing and curriculum issues.[17,49] They also identified detailed problems which are specific to the modules they are running.[52,54,56,61,63] Intellectual property rights, copyright and plagiarism are problems.[49,51,56] Learners need appropriate content, wide choice and guidance on selection.[25,49,59] They can lack motivation to undertake study.[24] Learners need to change their learning styles[19,21,24,25,32,35,47,63] and may see lack of interactivity as a problem and prefer personal contact.[21,26,29,33,35,64] E-learning can be time consuming[27,35,53] with a significant risk of information overload.[51] Copyright and plagiarism are issues for learners.[51] There are language barriers for foreign students.[40] Learners also identified detailed issues which are specific to the modules they are undertaking.[30,52,54,57,60,61] There is a risk of creating a two tier system of education with the bottom tier being those learners who do not have access to the Internet or whose trainers do not choose to use e-learning methods.[55] Concerns about negative effects on patient care have been raised, both in terms of managing additional tasks and of interference in the doctor–patient relationship[18] and little focus is given to how to apply IT to practice.[51]

From a managerial viewpoint, solutions include a national approach with standards, quality assurance and integrated services.[9,39] Evaluation of e-learning packages is needed.[34] Collaboration is required between content, pedagogy and technology.[15,41] E-learning needs to be integrated into

the curriculum.[18,32,35,38] Flexibility for learners needs to be built into the programme[45] and trainers must be flexible to adapt to the needs of learners.[42] E-learning packages need to be tailored to local needs, regularly modified and kept up to date.[12] Accreditation and outcomes should be equivalent to traditional methods.[32] From the trainer and learner perspective there are many factors that result in effective e-learning programmes, courses and materials. Collaboration is needed in the design process between content, pedagogy and technology.[41] Courses and packages should be piloted, and then evaluated regularly.[12,13,15,39–41,45] Trainers and learners should share responsibility for the quality of the learning process.[32] E-learning should be based on principles of evidence, standards of care, academic freedom and respect for copyright rules.[39] Blended teaching, incorporating both traditional and e-learning methods, seems the preferred approach.[25,35,60] Content needs to be relevant, e.g. more NHS orientated[15,25,36] and be logically organized.[36,45] Content can be divided into small learning 'chunks' which are flexible, recyclable and deliverable in a variety of formats.[13,53] There should be flexibility and variety in the use of methods[10,28,41,46,63] and imagery as well as video and multimedia are of benefit.[10,18,36,46,53,64,65] The design should allow for self-pacing (within a module and between modules)[18,30,36,45,47,60] and provide interactivity.[21,36,41,46,53] The package should be easy to use[13,39,65] with good navigational tools.[60] Support should be provided on use of the package and the content, e.g. being clear about assignments and timelines[19,35] providing 'wrap around guides'[23] and support materials.[35,61,65] Learners should be given feedback on their progress.[13,18,39,53] User testing and assessment should be provided,[13,35,45,46,53,60] but it is important that assessment results are consistent with traditional methods.[46] If the language is tailored appropriately the package will be accessible to international users.[41] There is a need to identify and disseminate examples of good practice.[38]

Psychological issues—barriers and solutions

From a managerial viewpoint, barriers comprise resistance to change[13,34] and how to motivate trainers to undertake e-learning.[17] For trainers barriers comprise: resistance to change;[10,19] motivation and motivators;[17,20] technophobia, computer anxiety and lack of IT confidence;[18,51,56] dissatisfaction at losing the benefits and enjoyment of personal contact with learners and other trainers.[32,49,54,56] Learners had similar barriers: resistance to change[13] with women possibly more resistant to the introduction of computer-based innovations;[50] motivation[26] and negative views of the value of e-learning;[16] technophobia, computer anxiety and lack of IT confidence;[13,16,18,19,24,33,51] lack of interactivity and preference for personal contact;[49,52,53,56,57,64] lack of control;[21] specific issues with particular types of technology such as newsgroups[27] and live video sessions.[52]

Trainers need to prepare for role change, from one of dispensing knowledge to one of guidance and support.[27] A blended approach, mixing person-to-person contact with IT methods, seems the most preferred.[26] E-learning must be learner centric.[36] E-learning is about learners managing their own learning.[31] Trainers need to support learner participation and interaction, either face to face or via video;[29,42,46,52] Web based environments can enable learners to contribute more to discussions.[31] Learners need to be reassured as they confront technological challenges.[19] Trainers need to provide a safe environment for failure.[13] Learners can learn from mistakes in a nonjudgemental atmosphere.[12]

Skills—barriers and solutions

From a managerial viewpoint, a barrier is the need for training for trainers and administrators[12,17,55] though there can be lack of trainer interest in new skills[34] and a lack of training opportunities.[10,17,38] Trainers lack appropriate skills and need training in, e.g. course design, development and delivery of e-learning, IT, information management.[9,10,17,38,47,51,55,62] Learners can also lack the necessary skills for e-learning, e.g. training needs assessment, IT skills, study and organizational skills, e-learning methodology, critical evaluation, internet searching.[12,17,18,19,21,26,27,35,43,50,56,63,64] They lack training and the time for training[17,18,20,38,50,51] although some learners may avoid the training they need.[51]

One possible solution for managers is to establish a policy that learners either take a basic computer

literacy course or demonstrate computer skills as a basic prerequisite for admission to e-learning courses.[27] Trainers themselves need training, e.g. in IT skills, e-learning techniques and information literacy/management skills.[17,21,27,38,51] Trainers need to be familiar with the packages and equipment.[13,35] Learners need skills training; in use of computers and the Internet;[21,26,27,51,56,64] in information literacy.[27,51,56] 'Wrap around guides' help learners manage their learning and navigate through the package.[23]

Interview and Questionnaire Results

As shown in the methodology section, the questions for the interviews and questionnaires were based on the results of the systematic literature review. This approach was used to test whether the results from the review reflected people's actual experiences. However, the review covers e-learning issues in more breadth and depth and not every topic in the review could be explored in the interviews and questionnaires. Overall the results from the interviews (managers and trainers) and questionnaires (learners) do support the reality of the findings from the review. There were some differences, which may be a reflection that, by its nature, information from the literature is less current. E-learning has progressed and access to technology has improved since the published studies described here. The managers/trainers agreed on barriers caused by requirement for change, poorly designed packages, inadequate technology, lack of skills, costs, need for a component of face-to-face teaching, time intensive nature of e-learning (though they were less concerned about trainers time issues), and need for standardization (though this was not mentioned by many respondents). The learners gave some agreement to the barriers caused by time issues, poorly designed packages, lack of face-to-face teaching, lack of skills, lack of support and costs. There was not a lot of support for the barrier caused by lack of access to technology. The managers/trainers agreed on the following solutions: strongly about standardization, strategies, funding, integration, skills training, support; less strongly about reviewing software, faster feedback, commitment; no responses on communication and timetabling; negative responses on trainer incentives and admission criteria. The learners agreed strongly on the following solutions: blended teaching, user-friendly packages, skills training, free courses, access to technology. They noted one solution—their employer giving them work time for e-learning—which was not mentioned in the literature.

The topic of the effectiveness of e-learning was explored in the interviews and questionnaires. Information on this topic was not extracted from the literature though it was present in some of the articles. Views on the effectiveness of e-learning were very positive. The majority of managers/trainers considered e-learning to be effective. However, they added provisos that this was dependent on the way it is implemented and the attitude and skills of the learner. They were more pessimistic about whether the necessary changes had occurred to implement e-learning. The situation was very variable and dependent on the specific organization involved. Learners' views were very positive. They thought that e-learning was effective and improved education and training.

Discussions

The systematic literature review covered e-learning barriers and solutions from managers, trainers and learners viewpoints. What of the librarians' viewpoint? What role can librarians and libraries play in e-learning? Libraries and librarians were not specifically mentioned in the review. However, the solutions to e-learning barriers collated by the HeXL project suggest a number of areas in which librarians could play key roles in e-learning. Support is an important requirement. Librarians can provide both individual support (online or by phone) and support materials in both paper and electronic formats. This support is needed by both trainers and learners. Skills training is another important requirement. Librarians can provide the necessary information literacy skills training for both trainers and learners. Librarians produce e-learning materials. The library website providing access to e-journals, e-books and quality internet resources is a crucial component of any e-learning programme. Librarians could also produce their information literacy skills training in the form of e-learning courses or 'chunks' (learning objects).

Some of the recommendations for good design of packages suggest that librarians could have a role in assisting trainers to evaluate packages or develop their own material, e.g. e-learning based on the principles of evidence, logical organization of content and good navigation. Perhaps the design process should require the collaboration of content, pedagogy, technology and libraries/information management. None of these activities are actually new roles for librarians. They are what librarians have always done but in a new context, e-learning. The problem is often one of perception by non-librarians who do not recognize what librarians can contribute. Do the recently published national e-learning strategies recognize a role for librarians in e-learning?

The DfES' e-learning strategy[3] mentions libraries a number of times: the value of digital libraries and digital library resources, and the provision of easy access to these; libraries as members of online networks; public libraries offering internet access; support from experts in online library skills; library staff as frontline professionals in education delivery; well-equipped libraries for school children; a personal online learning space for school children including contacting digital libraries and gaining online tutorial support when they are not in school; LearnDirect and UK online centres for adult learners provided in community locations such as public libraries; courses and learning programmes for adult learners in community locations such as public libraries; flexible work-based learning, with employees in the workplace, from home and at community locations such as public libraries. The HEFCE strategy[4] does not include so much mention of libraries but does note the importance of digital libraries and 'the emerging role of the librarian assisting learners and teachers and supporting delivery'. The discussion document for the NHS strategy[6] makes very little mention of libraries. It notes electronic libraries such as the National electronic Library for Health (NeLH), now part of the National Library for Health (NLH), and the People's Network in public libraries providing access to the Internet. It also notes the need for 'managed access to e-libraries and other resources'. Comments in the consultation[7] stated that NHS libraries should have been mentioned.

Conclusions

The results of the interviews and questionnaire survey show that both education providers (managers and trainers) and learners feel that e-learning is effective and improves education and training; the key benefit of e-learning is the flexibility it provides. For e-learning to be successfully delivered in the health context the systematic literature review identified the following factors which need to be in place:

- National approach, infrastructure, standards, guidelines, integrated services.
- National/local integration.
- Local strategies, supported by processes and procedures.
- Strong commitment from institution and trainers.
- Change management.
- Resource management.
- Integration of e-learning into the curriculum.
- Presence of a range of skilled staff—IT staff, design staff, trainers, support staff, administrators.
- Evaluation research, to identify cost-effectiveness and cost-benefits.
- Easy access to technology for both trainers and learners.
- Support for trainers—administrative and technical.
- Support for learners—trainer and technical.
- Skills training for trainers—IT, information literacy, e-learning development.
- Skills training for learners—IT, information literacy, e-learning study skills, time management.
- Flexibility of programmes, study methods and access to trainers and facilities so learners can maintain an appropriate work-life balance.
- Support for learners from their employers—managers' support, help with costs of e-learning, provision of work time for e-learning.
- Well designed e-learning programmes/courses/package:
  - Learner centric
  - Shared responsibility between trainers and learners
  - Blended teaching
  - Flexibility/variety in use of methods
  - Piloting of packages/courses and on-going evaluation
  - Relevant content
  - Logically organized content
  - Easy to use, with logical navigation

Self-pacing (within module and between modules)
Interactive
Providing for feedback
Providing for user testing/assessment
Support materials
Identification and dissemination of examples of good practice

The authors argue that librarians can play an important role in e-learning: providing support and support materials; teaching information skills; managing and providing access to online information resources; producing their own e-learning packages; assisting in the development of other packages.

Key Messages

Implications for Policy

- National accreditation and national standards and guidelines are needed to support e-learning.
- E-learning strategies are needed at both national and local level, with national/local integration.
- A strong commitment to e-learning is needed from the institution and the trainers, with e-learning being fully integrated into the curriculum.
- Change management is needed, to support change in education practice by organizations, trainers and learners.
- E-learning programmes must be flexible—in programme structure, module scheduling, study methods, access to support and facilities—and user-centred. Blended teaching is the preferred approach.

Implications for Practice

- Skills training in support of e-learning is needed, e.g. skills for trainers: course design, development and delivery of e-learning, IT, information literacy/information management, e.g. skills for learners: training needs assessment, IT, study and organization of learning, e-learning methods, Internet searching, critical evaluation.
- Support is important: technical and administrative support for trainers; trainer and technical support for learners.
- Easy access to reliable technology is needed for both trainers and learners.

References

1 Department of Health. *Working Together—Learning Together: A Framework for Lifelong Learning in the NHS.* London: Department of Health, 2001. Available at: http://www.dh.gov.uk/PublicationsAndStatistics/Publications/PublicationsPolicyAndGuidance/PublicationsPolicyAndGuidanceArticle/fs/en?CONTENT_ID=4009558&chk=tCWmaW

2 Department of Health. *Learning for Everyone: a Development Plan for NHSU*. London: Department of Health, 2002.

3 Department for Education and Skills. *Harnessing Technology: Transforming Learning and Children's Services*. London: DfES 2005. Available at: http://www.dfes.gov.uk/publications/e-strategy/

4 Higher Education Funding Council for England, Joint Information Systems Committee and Higher Education Academy. *Higher Education Funding Council for England Strategy for E-Learning.* London: Higher Education Funding Council for England, 2005. Available at: http://www.hefce.ac.uk/pubs/hefce//05–12/

5 Anon. *Delivering E-Learning in the NHS. Getting the Blend Right. A strategic approach for the North-West: a common strategy for Cheshire and Merseyside Workforce Development Confederation, Cumbria and Lancashire Workforce Development Confederation, Greater Manchester Workforce Development Confederation.* May 2003. Available at: http://www.aditus.nhs.uk/Aditus/Learning+Zone/E-Learning+Strategy/default.htm

6 NHSU. *E-learning for Health: A discussion paper. Towards a strategy for NHSU, SHAs, partners and stakeholders.* London: NHSU, 2004.

7 Cumbria and Lancashire. Strategic Health Authority. *E-learning for Health: A discussion paper. Analysis of responses to NHSU's/Strategic Health Authorities' e-learning consultation.* London: NHSU, 2005.

8 Centre for Reviews and Dissemination. *Undertaking Systematic Reviews of Research on Effectiveness: CRD's Guidance for Carrying Out or Commissioning Reviews*, 2nd edn. CRD Report 4. York: Centre for Reviews and Dissemination, 2001.

Systematic Literature Review Bibliography

Note: The context of the article is coded as follows: * = Clinical; ** = Higher education; *** = Other.

9 Department of Health. *Working Together—Learning Together. A Framework for Lifelong Learning in the NHS*. London: Department of Health, 2001, Available at: http://www.dh.gov.uk/PublicationsAndStatistics/Publications/PublicationsPolicyAndGuidance/PublicationsPolicyAndGuidanceArticle/fs/en?CONTENT_ID=4009558&chk=tCWmaW *

10 Meyer, S. M. The adoption of technology in higher/nursing education. *Curationis* 2001, **24**, 32–6. **

11 Petrusa, E. R., Issenberg, S. B., Mayer, J. W., Felner, J. M., Brown, D. D., Waugh, R. A., Kondos, G. T., Gessner, I. H. & McGaghie, W. C. Implementation of a four-year multimedia computer curriculum in cardiology at six medical schools. *Academic Medicine* 1999, **74**, 123–9. **

12 Grigg, P. & Stephens, C. D. Review. Computer-assisted learning in dentistry. A view from the UK. *Journal of Dentistry* 1998, **26**, 387–95. **

13 D'Alfonso, J. & Halvorson, C. K. E-learning in perioperative education. *Surgical Services Management* 2002, **8**, 20–2. *

14 Henderson, J. V. Comprehensive, technology-based clinical education: The 'virtual practicum'. *International Journal of Psychiatry in Medicine* 1998, **28**, 41–79. **

15 Higgins, S. A. K. & Thorne, D. Computers. Developmental considerations for computer-assisted instruction. *Laboratory Medicine* 1998, **29**, 366–70. ***

16 McCloy, R. & Stone, R. Virtual reality in surgery. *British Medical Journal* 2001, **323**, 912–5. *

17 Thomas, B. S. Instructional computing in American nursing programs. *International Journal of Nursing Studies* 1986, **23**, 221–9. **

18 Goncewinder, C., Kidd, R. O. & Lenz, E. R. Optimizing computer-based system use in health-professions education-programs. *Computers in Nursing* 1993, **11**, 197–202. *

19 Ouellette, P. M. & Briscoe, R. Walking through the fire: integrating technology to enhance the research skills of minority mental health student researchers. *Journal of Technology in Human Services* 2002, **19**, 91–107. **

20 McAuley, R. J. Requiring students to have computers: Questions for consideration. *Academic Medicine* 1998, **73**, 669–73. **

21 Olson, D. K., Cohn, S. & Carlson, V. Technology enhanced learning for occupational and environmental health nursing: a global imperative. *AAOHN Journal* 2000, **48**, 175–84. *

22 Graveley, E. & Fullerton, J. Incorporating electronic-based and computer-based strategies: Graduate nursing courses in administration. *Journal of Nursing Education* 1998, **37**, 186–8. **

23 Lowry, M. & Johnson, M. Computer assisted learning: the potential for teaching and assessing in nursing. *Nurse Education Today* 1999, **19**, 521–6. **

24 Dawes, D. & Hanscomb, A. Focus. A pilot study to assess the case for e-learning in the NHS. *NT Research* 2002, **7**, 428–43. *

25 Leading by example. *Training Magazine* 2002: (October), 16–7. *

26 Mamary, E. M. & Charles, P. On-site to on–line: Barriers to the use of computers for continuing education. *Journal of Continuing Education in the Health Professions* 2000, **20**, 171–5. *

27 Thiele, J. E., Allen, C. & Stucky, M. Effects of Web-based instruction on learning behaviors of undergraduate and graduate students. *Nursing and Health Care Perspectives* 1999, **20**, 199–203. **

28 Wambach, K., Boyle, D., Hagemaster, J., Teel, C., Langner, B., Fazzone, P., Connors, H., Smith, C. & Forbes, S. Beyond correspondence, video conferencing, and voice mail: Internet-based master's degree courses in nursing. *Journal of Nursing Education* 1999, **38**, 267–71. **

29 Andrusyszyn, M.-A., Iwasiw, C. & Goldenberg, D. Computer conferencing in graduate nursing education: Perceptions of students and faculty. *Journal of Continuing Education in Nursing* 1999, **30**, 272–8. **

30 Delafuente, J. C., Araujo, O. E. & Legg, S. M. Traditional lecture format compared to computer-assisted instruction in pharmacy calculations. *American Journal of Pharmaceutical Education* 1998, **62**, 62–6. **

31 Lockyer, L., Patterson, J. & Harper, B. Measuring effectiveness of health education in a web-based learning environment: a preliminary report. *Higher Education Research and Development* 1999, **18**, 233–46.**

32 Ouellette, P. M. Moving toward technology-supported instruction in human service practice: The 'virtual classroom'. *Journal of Technology in Human Services* 1999, **16**, 97–111. **

33 Randell, D. E-learning for continuing education: exploring a new frontier. *MLO (Medical Laboratory Observer)* 2001, **33**, 24–8. *

34 Hayne, Y. Instructional computing in Alberta nursing programs as perceived by program leaders. *AARN Newsletter* 1989, **45**, 29–32. *

35 Cooksey, K., Kohlmeier, M., Plaisted, C., Adams, K. & Zeisel, S. H. Getting nutrition education into medical schools: a computer-based approach. *American Journal of Clinical Nutrition* 2000, **72**, 868S–876S. **

36 Clark, D. Psychological myths in e-learning. *Medical Teacher* 2002, **24**, 598–604. *

37 Schleyer, T. Assessing outcomes of an academic computing initiative. *Journal of Dental Education* 1998, **62**, 432–40. **

38 Wright, G. IM & T in the nursing curriculum. *Health Informatics* 1995, **1**, 26–8. **

39 Nattestad, A., Attstrom, R., Mattheos, N., Ramseier, C., Canegallo, L., Eaton, K., Feeney, L., Goffin, G., Markovska, N., Maixner, W., Persson, R., Reynolds, P., Ruotoistenmaki, J., Schittek, M., Spohn, E. & Sudzina, M. 41 Web-based interactive learning programmes. *European Journal of Dental Education* 2002, **6**, 127–37. **

40 Turchin, A. & Lehmann, C. U. Active Learning Centre: Utilization patterns of an interactive educational World Wide Web site. *Proceedings of the AMIA Symposium* 1999, 627–31. **

41 Konstan, J. A., Sturm, P., Mcleod, J. & Lichtblau, L. Internet self-assessment in pharmacology: a model for Internet medical education. *Computers and Education* 1997, **29**, 63–71. **

42 Pande, J. & Hart, L. A. An online course in health policy: Pearls and perils of cyberspace teaching. *Distance Education Report* 1998, **2**, 4–5. **

43 Hodgson, M. E-learning. *General Practice Manager Briefing* 2001, **71**, 5–8. *

44 Harden, R. M. & Hart, I. R. An international virtual medical school (IVIMEDS): the future for medical education? *Medical Teacher* 2002, **24**, 261–7. **

45 Billings, D. M. & Rowles, C. J. Development of continuing nursing education offerings for the World Wide Web. *Journal of Continuing Education in Nursing* 2001, **32**, 107–13. **

46 Ware, S. K., Olesinski, R. L., Cole, C. M. & Pray, M. L. Teaching at a distance using interactive video. *Journal of Allied Health* 1998, **27**, 137–41. **

47 Schittek, M., Mattheos, N., Lyon, H. C. & Attstrom, R. Computer assisted learning. A review. *European Journal of Dental Education* 2001, **5**, 93–100. **

48 Rafferty, J. *Update on Elearning Project*. Southampton: Faculty of Social Sciences. University of Southampton, 2003. (Original report: Rafferty, J. & Waldman, J. *Building capacity to support the social work degree. A Scoping Study for the Department of Health e-learning Steering Group.* Southampton: Social Policy and Social Work Learning and Teaching Support Network (SWAPltsn), Faculty of Social Sciences. University of Southampton, 2003. Original report available at: http://www.dh.gov.uk/assetRoot/04/03/46/94/04034694.pdf. Website: http://www.swap.ac.uk/elearning/introduction.asp) **

49 Riordan, J. Insights in practice. Teaching breastfeeding on the Web. *Journal of Human Lactation* 2000, **16**, 231–4. **

50 Washer, P. (2001) Barriers to the use of web-based learning in nurse education. *Nurse Education Today* 2001, **21**, 455–60. **

51 Kenny, A. Untangling the Web … barriers and benefits for nurse education … an Australian perspective. *Nurse Education Today* 2000, **20**, 381–8. **

52 Smith, T. A., Raybould, T. P. & Hardison, J. D. A distance learning program in advanced general dentistry. *Journal of Dental Education* 1998, **62**, 975–84. **

53 Hogg, P., Boyle, T. & Lawson, R. Comparative evaluation of a CORE based learning environment for nuclear medicine. *Journal of Educational Multimedia and Hypermedia* 1999, **8**, 457–73. **

54 Odell, E. W., Francis, C. A., Eaton, K. A., Reynolds, P. A. & Mason, R. D. A study of videoconferencing for postgraduate continuing education in dentistry in the UK—the teachers' view. *European Journal of Dental Education* 2001, **5**, 113–9. **

55 Clark, G. T. Education problems and Web-based teaching: how it impacts dental educators? *Journal of the American College of Dentists* 2001, **68**, 25–34. **

56 Walmsley, A. D., White, D. A., Eynon, R. & Somerfield, L. The use of the Internet within a dental school. *European Journal of Dental Education* 2003, **7**, 27–33. **

57 Spallek, H., Berthold, P., Shanley, D. B. & Attstrom, R. Distance education for dentists: Improving the quality of online instruction. *American Journal of Distance Education* 2000, **14**, 49–59. **

58 Treharne, R. E-learning: A new way of learning. *National electronic Library for health (NeLH) Management Briefing*. 2002. Available at: http://rms.nelh.nhs.uk/healthManagement/briefings.asp *

59 MacPherson, K. I. Menopause on the Internet: building knowledge and community on-line. (State of the Art). *Advances in Nursing Science* 1997, **20**, 66–78. **

60 Harrold, M. W. & Newton, G. D. Development and evaluation of computer-based tutorials in biochemistry and medicinal chemistry. *American Journal of Pharmaceutical Education* 1998, **62**, 24–30. **

61 Sosabowski, M. H., Herson, K. & Lloyd, A. W. Implementation and student assessment of intranet-based learning resources. *American Journal of Pharmaceutical Education* 1998, **62**, 302–6. **

62 Harden, R. M. Myths and e-learning. *Medical Teacher* 2002, **24**, 469–72. *

63 Mattheos, N., Nattestad, A., Schittek, M. & Attstrom, R. A virtual classroom for undergraduate Peridontology: a pilot study. *European Journal of Dental Education* 2001, **5**, 139–47. **

64 Charles, P. A. & Mamary, E. M. New choices for continuing education: a statewide survey of the practices and preferences of nurse practitioners. *Journal of Continuing Education in Nursing* 2002, **33**, 88–91. *

65 Davis, M. J., Wythe, J., Rozum, J. S. & Gore, R. W. Use of World Wide Web server and browser software to support a first-year medical physiology course. *Advances in Physiology Education* 1997, **17**, S1–S14. **