



How digital libraries can support e-learning

Digital libraries
and e-learning

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Abstract

Purpose – Digital libraries have the potential to offer unprecedented resources for supporting e-learning. This paper addresses and discusses such aspects as what is meant by “e-learning”, and how can it be supported by the library environment, the functionality of the digital library; and how e-learning resources are included and organized in the digital library.

Design/methodology/approach – The paper explores the advantages of digital libraries for e-learning and the types of learning that can be supported by digital libraries.

Findings – There is undoubtedly a keenness to use online information resources for research and teaching, but this seems to be matched by a lack of awareness of how best to integrate these resources into the e-learning environment.

Originality/value – The paper provides a useful insight into the role and influence of digital libraries and online resources on e-learning.

Keywords Digital libraries, E-learning, Internet, Worldwide web, Library services

Paper type Research paper

1. Introduction

The growth in e-learning, in which education is delivered and supported through computer networks such as the internet, has posed new challenges for library services. E-learners and traditional learners now have access to a universe of digital information through the information superhighway. New information and communications technologies, as well as new educational models, require librarians to re-evaluate the way they develop, manage and deliver resources and services.

This paper examines how digital libraries are responding to the challenges of delivering core services to e-learners. The paper will examine library practices and technologies being applied in the construction of digital libraries. Challenges and opportunities which digital libraries bring to the support of e-learners, as well as the importance of providing support within a collaborative environment, which stresses human factors such as communication and interaction, will also be discussed.

2. Digital library origins and definitions

The term “digital library” is simply the most recent in a long series of names for a concept that was written about long before the development of the first computer. The idea of a “computerized library” that would supplement, add functionality, and even replace traditional libraries was first invented by H.G. Wells and other authors, who caught the imagination of millions with speculative writings about “world brains” and similar fanciful devices.

There is general agreement that much of the early actual application of computers to information retrieval was stimulated by the prominent scientist Vannevar Bush,



who wrote about the “memex”, a mechanical device based on microfilm technology that anticipated the ideas of both hypertext and personal information retrieval systems (Bush, 1945). The first real-world applications of computers to libraries began in the early 1950s with IBM and punched card applications to library technical services operations, and with the development of the MARC (machine-readable cataloging) standard for digitizing and communicating library catalogue information. In 1965, J.C.R. Licklider coined the phrase “library of the future” to refer to his vision of a fully computer-based library (Licklider, 1965), and later, F.W. Lancaster (1978) wrote of the soon-to-come “paperless library”. Many other terms have been coined to refer to the concept of a digital library, including “electronic library”, “virtual library”, “library without walls”, “bionic library”, and others (Drabenstott, 1994).

There is little discussion and less agreement in the literature about what constitutes a digital library. One may insist on a relatively narrow definition, based explicitly on the properties of the traditional print library, or consider a much broader continuum of possibilities. The most inclusive view takes a digital library to be, as its starting point, essentially what the internet is today. But from this extreme perspective it can be seen that the metaphor of the traditional library fails in several respects.

A digital library was defined by Lynch (1995) as an “electronic information access system that offers the user a coherent view of an organized, selected, and managed body of information”.

The Digital Library Federation (1998) suggests the following working definition of the digital library:

Digital libraries are organizations that provide the resources, including the specialized staff, to select, structure, offer intellectual access to, interpret, distribute, preserve the integrity of, and ensure the persistence over time of collections of digital works so that they are readily and economically available for use by a defined community or set of communities.

Based on this working definition, a digital library is not merely equivalent to a digitized collection with information management tools. It is also a series of activities that brings together collections, services, and people in support of the full life cycle of creation, dissemination, use, and preservation of data, information, and knowledge.

3. E-learning terminology

Different terminologies have been used for e-learning, a fact that makes it difficult to develop a generic definition. Terms that are commonly used include “online learning”, “internet learning”, “distributed learning”, “networked learning”, “tele-learning”, “virtual learning”, “computer-assisted learning”, “web-based learning”, and “distance learning”. All of these terms imply that the learner is at a distance from the tutor or instructor, that the learner uses some form of technology (usually a computer) to access the learning materials, that the learner uses technology to interact with the tutor or instructor and other learners, and that some form of support is provided to learners. This paper will use the term “e-learning” throughout.

E-learning is the term used to describe teaching and learning resources or experiences that are, in some way, delivered electronically. E-learning is meant to be more than just educational websites or computer software. It includes all aspects of electronic delivery – so watching an educational video, using a digital camera, using a

computer to edit pictures, text or sounds for a presentation or project, or using an interactive whiteboard in a lesson, can all be considered implementations of e-learning.

There are many definitions of e-learning in the literature, definitions that reflect the diversity of practice and associated technologies. Carliner (1999) defines e-learning as educational material that is presented on a computer. The Australian National Training Authority (2003) proposes that:

... e-learning is a broader concept [than online learning], encompassing a wide set of applications and processes which use all available electronic media to deliver vocational education and training more flexibly [...] the general intent to support a broad range of electronic media (internet, intranets, extranets, satellite broadcast, audio/video tape, interactive TV and CD-ROM) to make vocational learning more flexible for clients.

Brunel University (2004) equates an e-learning strategy with web-enhanced learning.

However, e-learning involves more than just the presentation and delivery of the materials using the web; the learner and the learning process should be the focus of e-learning. As a result, in this paper e-learning is defined as:

... the use of the internet to access learning materials; to interact with the content, instructor, and other learners; and to obtain support during the learning process, in order to acquire knowledge, to construct personal meaning, and to grow from the learning experience.

4. Benefits of e-learning

Increasingly, organizations are adopting e-learning as the main delivery method to train employees (Simmons, 2002). At the same time, educational institutions are moving toward the use of the internet for delivery, both on campus and at a distance. However, for organizations and institutions to make this often expensive move, there must be a perception that using e-learning provides major benefits. Some of the benefits for learners and instructors are outlined below.

For learners, e-learning knows no time zones, and location and distance are not an issue. In asynchronous e-learning, students can access the online materials at any time, while synchronous e-learning allows for real-time interaction between students and the instructor. E-learners can use the internet to access up-to-date and relevant learning materials, and can communicate with experts in the field in which they are studying. Situated learning is facilitated, since learners can complete online courses while working on the job or in their own space, and can contextualize the learning.

For the instructor, tutoring can be done at anytime and from anywhere. Online materials can be updated, and learners are able to see the changes at once. When learners are able to access materials on the internet, it is easier for instructors to direct them to appropriate information based on their needs. If designed properly, online learning systems can be used to determine learners' needs and current level of expertise, and to assign appropriate materials for learners to select from to achieve the desired learning outcomes.

Important trends are characterized by the new requirements imposed on the knowledge industry in partnership with educators and librarians to provide adequate changes in education methods and information infrastructures to support e-learning as a lifetime activity, learning any time and anywhere.

In this competitive era the role of the traditional library as the primary provider of information to its community is less and less unique. Local collections and staff are no

longer the only source of information services to students including e-learners and support for faculty in their research and teaching. Users (students/e-learners) are beginning to perceive the library as something used at the end, or at best the middle, of their information search. This has important implications for education programs, as well as for understanding library users' behaviour. Users want control of their own information environment. It is important to them to have some items owned for convenient personal consultation. The user's impression is that the information available free on the web is the information that gets used. If students do need to ask a person for information help, they go to a friend or colleague because that person already has an understanding of that person's context for either the problem or their level of understanding.

One of the natural responses to the above challenges consists of introducing the digital library to support e-learning as a learning environment and resources network, designed to meet the needs of learners, in both individual and collaborative settings, constructed to enable the dynamic use of a broad array of materials for learning primarily in digital format, managed actively to promote reliable any time, anywhere access to quality collections and services, available both within and outside the network (Lippincott, 2002).

5. The role of digital libraries in e-learning

The introduction of digital libraries into the education process was made easier by distance education, which has developed over the years. With the internet and the worldwide web, distance education programs can mount sets of materials on web servers to support online courses. One of the basic ideas is to join learning materials on various topics, written by many educators, in a digital library of courseware. Digital libraries have the potential to significantly change fundamental aspects of the classroom in ways that could have an enormous impact on teaching and learning. New pedagogical methods should accompany digital libraries as an emerging technology for education to reach the compelling vision of education.

Raitt (2000) reports some of the digital library projects in Europe that are forming the next generation of libraries. The digital library must not be seen as merely a digitised collection of information objects plus related management tools, but as an environment bringing together collections, services, and people to support the full cycle of creation, dissemination, use and preservation of data, information, and knowledge. A number of intermediate goals have been formulated for digital libraries and the way in which they can support e-learning, including:

- improve student performance;
- increase the quantity, quality and comprehensiveness of internet-based educational resources;
- make these resources easy to discover and retrieve for students, parents, and educators; and
- ensure that these resources are available over time (Lee, 2001).

In the e-learning environment, digital libraries are considered as a federation of library services and collections that function together to create a digital learning community. The range of supported materials includes curricula and courseware materials,

lectures, lesson plans, computer programs, modelling and simulation, intelligent tutoring systems, access to remote scientific instruments, project-based learning, tools, the results of educational research, scientific research reported both formally in journals and informally in web sites, raw data for student activities, and multimedia image banks. Digital libraries should provide services for authors and instructors such as annotation, evaluation, and peer review of donated materials. For students and faculty, it will offer the capability to search for desired information by subject area, to have access to scientific data sets, to interact with peers, to provide archiving, location-independent naming, recommender systems, selective dissemination of information, copyright management. Faculty, students, and other clients such as independent learners will be able to participate in forums. Interdisciplinary activities, lifelong learning, and the process of education will all benefit. In this way, digital libraries will be much more than the sum of its parts, and will promote change and innovation in education.

6. E-learners, digital libraries and Information utilization

With the tremendous growth of the internet, e-learners have access to an overwhelming range of information sources available at the click of a mouse: library resources, government information, news sites, advertising, and many other forms of resources. Librarians have traditionally selected and organized resources with great care. In building digital libraries, librarians have the opportunity to provide e-learners with direction and to rescue them from information overload.

A digital library can link e-learners to library catalogues, licensed journal databases, electronic book collections, selected internet resources, electronic course reserves, and tutorials, and to forums for communication and interaction with others. The digital library permits e-learners to access library and networked resources and services anytime and anywhere that an Internet connection and computing equipment are available.

A significant challenge for digital library design and use in the new era will be to support the range of goals that are already alive in the classroom, rather than simply modify information. How can digital libraries and their use open up an e-learner's inquiries, rather than bring them to closure? How might they enhance an e-learner's critical thinking, rather than dulling it? How might they assist in teaching e-learners search processes, rather than mystifying or suppressing this instruction? Without asking the real value of using digital libraries or any educational technologies, educators risk failing to see their transformative potentials, and at worst, they risk importing a contrary set of values that are embedded in such systems from their histories in other locations. For digital libraries, such an implicit value could be summarized as "complete information access leads to better education", just as it may lead to better academic research and work. However, the many educators and librarians who have stacked unused textbooks and shrink-wrapped software packets in the corners of their rooms know that access is only a beginning.

E-learners' use of different technologies, whether they are traditional materials or digital resources available via the internet, will be informed by and in turn will help construct the kinds of values that retain significance in education. As long as the educator and the assignment follow the status quo, any related source of information is likely to be a smart choice by e-learners according to their assessment of what to do for

assignments. It follows both the form and content of what an eventual report should look like. Further, e-learners are often pressed for time, either by university scheduling or procrastination, and will often find the most efficient ways of completing work, a quality that educators find both admirable and dismaying. The stated and unstated values of an educational context will further intersect with the interests and needs of the e-learners, as well as with availability and nature of technological tools she or he is using.

7. Digital libraries and e-learning linkage: institutional concerns

The literature would suggest that effective and efficient linkage of e-learning environments and digital libraries needs to be recognized by senior management in the long-term strategic planning of the individual institutional mission, identifying their own specific cultural, social and educational requirements. Kovel-Jarboe (2001) concentrates on the potential for the linkage of e-learning environments and digital libraries to produce additional and innovative ways to enhance the teaching and learning experience. However, as a result of the change in teaching and learning methods, there is a potential likelihood for the blurring and uncertainty over professional roles within an institution (Kovel-Jarboe, 2001). Increased responsibilities of library staff may mean they are required to teach new information retrieval skills, as well as provide content development and input, deal with legal matters, maintenance and evaluation of the new learning materials. Rezaei Sharifabadi (2004) examines the role of the university libraries and librarians in the digital age and concludes that “as technology continues to transform the classroom and campus environment, librarians must be trained to deal with new problems and questions”.

The digital library serves mainly as a facilitator in organizing and providing knowledge and resources to its users. Sharing knowledge and information among library staff, researchers, faculty, students, and other departments within the institution encourages them to work together, develop their skills, and form strong and trusting relationships. A focus on collaboration between the library and the faculty promotes a responsive approach to course design and supports teaching and learning objectives, particularly when this collaboration incorporates student contributions and feedback. All parties must have a common vision in which each one participates actively by contributing their skills and perspectives to the building of a genuine partnership. This new approach considers the library as an active partner of the learning community, helping learners to become “information literates” by integrating information literacy skills into the curriculum. As Peacock (2005) notes:

... librarians, as educators, must demonstrate the hypothesis that the design and delivery of information literacy-rich curriculum rooted in rigorous pedagogical principles and blended with the astute use of ICT will result in profound learning. In order to lead a shift in practice, we must prove that such an approach is not only viable but also vital.

From a research perspective, a number of models can be involved in creating an environment that is responsive to the scholarly information needs of a diverse group of e-learners. Librarians locate, select and describe quality internet resources, and provide access to journal databases and electronic book collections, providing e-learners with full-text content from a wide range of online resources and publications, including peer-reviewed journals. Within this framework, the library works with faculty,

researchers, scholarly societies, and publishers in developing and managing a collection of enriched online scholarly resources. Such a partnership enables researchers to interact with others, exchange experiences, and publish their works online. The library role is thus transformed from simply being a provider of library resources, into meeting the ongoing support needs of the parties involved. The library also serves to foster research skills by encouraging students and other learners to search, investigate, discover, and take advantage of these valuable online resources.

Management support is as much a key to success in developing the digital library as in any other project. The university's strategic plan should incorporate a distinct section related to library strategies and projects, and explains how these strategies are aligned with the overall mission of the university. A digital library should have a high-profile leader, a key person who can work to obtain the support of the institution's management and promote a climate of change (Borgman, 2001).

Technological changes have been the dominant force reshaping library services. Instilling a culture of sharing, motivation, equity, and active partnering encourages library staff to respond positively to the changing roles, responsibilities, and skills that the integration and use of technology requires. A well designed ongoing training program enables library staff to upgrade their skills to their new assignments, and helps them to understand and control fear of change.

8. E-learners' expectations from librarians

Communication is not just important to break the isolation of students in an e-learning environment but also for a much more basic reason: whatever one person says or writes, the receiver of the information will always interpret the information in the receiver's personal context, created through upbringing, culture, language, etc. This does often lead to deep misunderstandings. The only way to make sure that information is properly understood is not by reading, hearing, seeing, but by being able to check if things have been understood and by asking questions: this is why an e-learning system that ignores the importance of communication will not work.

What do e-learners need from librarians? Suggestions advocating change in librarians' roles in support of e-learning in the information age appear throughout the literature: librarians "must assert themselves as key players in the learning process thereby changing their roles from information providers to educators" (Cooper and Dempsey, 1998), and they have been transformed from "information gatekeepers" to "information gateways" (Haricombe, 1998). Lippincott (2002) advocates librarian involvement in learning communities: "The librarian can shift the focus from explaining library resources to meeting the ongoing information needs of the students in the broad information environment".

In responding to the need to provide ongoing digital library support, librarians have worked at translating what they do in a traditional library into virtual or digital environments, while customizing their services and resources for e-learners. The traditional role of academic library services has always been to provide information resources for the teaching and learning activities within university. Its role in supporting the virtual learning environment (VLE) is no different. The linking of digital libraries and virtual learning environments is required to provide a meaningful connection between learning activities and learning resources. The digital library can help provide information content to teaching staff who are engaged in e-learning. Traditionally,

libraries offer circulation services, interlibrary loans, course reserves, an information desk, a reference desk, and library instruction. To serve learners connected to their institutional library primarily through a computer network, librarians are providing remote access to, and electronic delivery of, library resources, and are using communication technologies to deliver electronic reference services and instructional support.

As the literature suggests, e-learners are a wider community of learners than “students”. An academic library’s learners may include students, faculty, staff, researchers, and so on. The library is seen as a source of training and guidance to a community of learners who are concerned with navigating the complexities of locating and using digital resources and services. Moreover, the move towards a digital environment has resulted in a shift from the systematic one-to-one information flow of the past to a new model in which the users and the providers of information are able to relate in a many-to-many, dynamic relationship. For example, in the traditional model, a librarian provides a bridge between learners and information providers by selecting and cataloguing resources and by providing assistance with these resources. In the new model, the library serves as a facilitator by offering ongoing support enabling learners to interact and exchange knowledge with others, to communicate directly with the publishers and vendors of information resources, and to participate in a collaborative endeavour to make available rich collections of online scholarly information resources.

9. E-learners and digital library resources

Technology offers opportunities to be innovative, as the following discussion of electronic resources and services demonstrates, but it is important to bear in mind that not all e-learners are equal when it comes to access to computing equipment, the availability, speed, and stability of internet connections, or the information skills that are needed to make optimum use of digital libraries.

Access to print-based library materials continues to be important, because not all of the information resources that e-learners need are available in electronic format: many of our most valuable research materials are still print-based. Although there has been a shift away from purchasing print materials to be housed in a physical building and toward providing access to licensed digital resources made available over a computer network, librarians continue to work to resolve issues pertaining to distance delivery of resources that are unavailable in digital format. Online catalogues and indexing and abstracting systems provide e-learners with convenient access to bibliographic information about valuable scholarly documents. When those documents are not available in full-text form online, a demand is generated for delivery from a library’s print collection or from the collections of other libraries through interlibrary loans. Typical solutions for delivery of non-digital formats include the use of mail and courier services, the establishment of collections at designated sites, and the negotiation of agreements with other libraries through consortia.

Given that a growing number of learners are accessing library collections online, librarians are working to develop an integrated approach to providing access to electronic resources that facilitates retrieval and reduces confusion. A library website can function as an information gateway, an entry point to a range of online resources, with key components being the library catalogue and journal databases. Most online catalogues permit the integration of electronic books and electronic journals, enabling

learners to locate items from digital and physical collections with one search. User services – such as the ability to check due dates, renew materials, and request materials online – are also provided. Gateways may also organize collections and incorporate directories.

As libraries work to enhance their presence on the web, a growing number are investigating the potential of electronic course reserves (e-reserves). The traditional course reserves desk of an academic library, with its limited copies, short loan periods, and high late fines, can be a considerable source of frustration for students. In the e-reserves model, the library makes available, through the worldwide web, items that faculty have selected and “placed on reserve” for students on a particular course. Many libraries have initiated their own e-reserve projects. Electronic delivery of course reserve material has become a hot topic in the library literature (Slade, 2005).

Managing the remote access and authentication issues involved in making digital resources available has become a significant area of support to users of the digital library (Hulshof, 1999). Librarians may be called upon to respond to questions concerning log-in and password information, browser configuration, software installation, and a range of troubleshooting needs. Access problems are hugely frustrating for e-learners, and must be resolved quickly. Ensuring that front-line library staff are adequately trained, providing clear instructions on the library’s website, and coordinating support activities with computing services personnel can contribute to effective technical support. E-learners also benefit from having a variety of means of contacting the library, including e-mail, web and fax.

10. Digital library reference services

E-learners require more than access to e-resources. Traditionally, a reference librarian acts as an additional type of resource, one who can be counted upon to provide expertise in making sense of library systems and research tools, and to offer a helping hand along that often slippery path known as the research process. Digital library users face additional challenges in mining relevant information out of a computer system that “obstinately” returns zero hits in response to a query that does not match the character strings in its database files.

The most common means of providing electronic reference services to remote users has been e-mail, the advantages and disadvantages of which have been well documented in the literature (Slade, 2000). The around-the-clock and around-the-world accessibility of e-mail allows users to connect with librarians beyond the walls of library buildings and outside the usual hours of operation. E-mail provides a written record of requests and responses, permits the electronic transmission of search results, and allows librarians time to reflect on requests. One of the most serious concerns about e-mail reference services is their impact on the traditional face-to-face reference interview, particularly the absence of the verbal and non-verbal cues that typically assist a librarian in effectively responding to a question.

Hulshof (1999) identifies three issues related to the use of electronic communication in serving virtual patrons (e-learners):

- (1) immediacy;
- (2) intricacy; and
- (3) interaction.

Because it is so easy for a learner to send a request electronically and have it arrive at the library instantly, there is a perception that the librarian's response will be as immediate. The learner may become frustrated, not realizing that the process of locating information and developing a response takes the librarian just as long when the request is made electronically as when it is made in person or in any other way. The more complex the request, the longer it will take for the librarian to clarify it and respond appropriately: a series of e-mail messages may be required, which will further reduce the immediacy of the e-mail request.

E-mail reference service can be enhanced and supplemented with additional technologies that raise the level of interaction with real-time or live communication. New innovations like chat technology allow e-learners and librarians to send text messages back and forth instantly, using a form of communication that is familiar to most internet users. Reference services using SMS cellphone text messaging is also a new service to allow library clients to contact the library reference desk anytime, anywhere (Access, 2004).

11. Digital library user instruction

Library instruction has always been a significant role that librarians have played. Reference librarians provide tours, introductory and subject-specific classroom instruction, as well as on-the-fly, at-the-point-of-need instruction in the reference department. The new challenge for librarians is to provide library instruction to a growing population of remote and/or distance e-learners. With the increase in digital library collections that are accessible outside the library via the internet, students are visiting libraries less frequently. Telephone and e-mail reference allow reference librarians to provide short and sometimes detailed reference assistance to e-learners but these media are too cumbersome for remote instruction. However, with the advent of real-time virtual reference, librarians now have the ability to provide instruction to remote and distance learners.

E-learners are frequently silent and invisible as they search and explore a digital library's resources, and they do not have the same access that on-campus learners have to formal library instruction sessions. With the array of digital resources available to them, the multiplicity of interfaces and search tools, and the need for evaluation and critical thinking when using the internet for research, "information literacy" skills are a must-have for e-learners. Information literacy is described as the "ability to locate, manage, critically evaluate, and use information for problem solving, research, decision making, and continued professional development" (Orr *et al.*, 2001). Further still, Bundy (2004a) has observed the role information literacy has to play in participative citizenship, personal empowerment and social inclusion. He believes that library and information services professionals have a responsibility to develop the information literacy of their clients (Bundy, 2004b). In their review of literature published on the topic of library instruction and information literacy in academic, school, public, special, and all types of libraries, Johnson and Jent (2004) concluded that collaboration was a strong theme, especially among academic and school libraries. Other themes include the globalism of information literacy, assessment, the use of course management systems, and the use and value of online tutorials.

Many libraries provide instruction to e-learners by making information available on their web pages, including frequently asked questions, library glossaries, research guides, and "how-to" pages. Online tutorials usually operate on a model in which the e-learner

interacts in isolation with a computer. Their effectiveness can be enhanced by the addition of more interactive forms of instruction. The librarians at the Florida Distance Learning Reference and Referral Centre, for example, have experimented with chat software to simulate a virtual classroom and open up “live” group instruction to e-learners (Viggiano and Ault, 2001). Luton (2004) describes Australian students’ experience and the way in which information literacy can be enhanced. In her recent paper, Julien (2005) reports a longitudinal study of information literacy instruction (ILL) in Canadian academic libraries, focusing on how instruction is organized, delivered, and evaluated.

12. Conclusion

In this paper, the author hopes that he has supplied a reasonably comprehensive summary of the current key areas of necessary interaction between the e-learning and digital library worlds, and also some perspective on common services that both of these worlds should draw upon rather than re-developing them.

In summary, digital library services are an essential component of a quality e-learning system. As access to internet-based courses grows, an increasing number of e-learners are dispersed around the globe, often in parts of the world where physical access to the collections of large academic and research libraries is impossible. These learners are largely dependent on the quality and academic usefulness of services that the digital library can offer electronically. The strength of digital libraries and digital collections depends on the relationships libraries develop and maintain with the creators, publishers, and aggregators of e-resources, as well as with those who use, learn from, and evaluate these resources. Providing ongoing technical, reference, and instructional support to e-learners requires that libraries redefine their values and services, collaborate with their users, and approach their tasks creatively.

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