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Publication Statement

VI. USER PARTICIPATION

PERCEPTIONS OF USABILITY AND USEFULNESS OF DIGITAL LIBRARIES

KRYSTYNA K. MATUSIAK

Abstract *This paper provides an overview of a case study research that investigated the use of Digital Library (DL) resources in two undergraduate classes and explored faculty and students' perceptions of educational digital libraries. This study found that students and faculty use academic DLs primarily for textual resources, but turn to the open Web for visual and multimedia resources. The study participants did not perceive academic libraries as a useful source of digital images and used search engines when searching for visual resources.*

The limited use of digital library resources for teaching and learning is associated with perceptions of usefulness and ease of use, especially if considered in a broader information landscape, in conjunction with other library information systems, and in the context of Web resources. The limited use of digital libraries is related to the following perceptions: 1) Library systems are not viewed as user-friendly, which in turn discourages potential users from trying DLs provided by academic libraries; 2) Academic libraries are perceived as places of primarily textual resources; perceptions of usefulness, especially in regard to relevance of content, coverage, and currency, seem to have a negative effect on user intention to use DLs, especially when searching for visual materials.

Keywords: Digital libraries, Usability, Usefulness, Perceptions, Use of Digital Resources

Krystyna K. Matusiak

INTRODUCTION

Academic libraries participate actively in the current digital revolution by offering scholarly content in a digital format through library websites and by successively digitising their unique collections of textual, visual, and multimedia resources. Digital collections created as a result of digitisation projects extend access to primary sources and provide new opportunities for academic teaching and learning. Digital libraries (DLs), however, are relatively new phenomena and research studies of their discovery, adoption, and use in higher education are still limited.

This paper presents the findings of a case study that investigated the use of DL resources in two undergraduate classes and explored faculty and students' perceptions of educational digital libraries. Information technology (IT) acceptance research indicates that perceptions of usefulness and usability are critical to user adoption of new information systems and their successful use.[1] This study builds upon the prior research of information system's acceptance and expands it by focusing on the adoption of educational digital libraries. Furthermore, it examines user perceptions of digital collections in a broader context of other online resources used for teaching and learning.

BACKGROUND

Research on perceptions provides insight into users' intentions to use digital libraries and sheds some light on barriers to a wider acceptance of digital library systems. Perceptions are the effects of human processes of recognition and interpretation of phenomena in an external world. As Smith[2] notes, 'an empirical world is an environment of which we are cognisant through perception – one that contains entities we can and do perceive.' Perceptions of entities, such as digital libraries can be formed through direct contact or can be inferred based on experiences with similar information systems.

Digital libraries represent emergent and complex forms of digital information organisation and design, consisting of multiple layers and building blocks, in various stages of development. DLs present a variety of resources created in the digital format as well as those converted from analog materials through digitisation efforts. The concepts of DLs are still evolving and cannot be captured by a simple definition[3]. Digital collections represent a building block of DLs and are created locally by libraries and cultural heritage institutions, as opposed to the digital content purchased or licensed from publishers and vendors.

The focus of this paper is on digital collections created by academic libraries in support of teaching and learning. Many libraries have undertaken digitisation projects in an effort to convert their unique collections of visual resources, maps, manuscripts, audio and video, and archival primary sources, and make
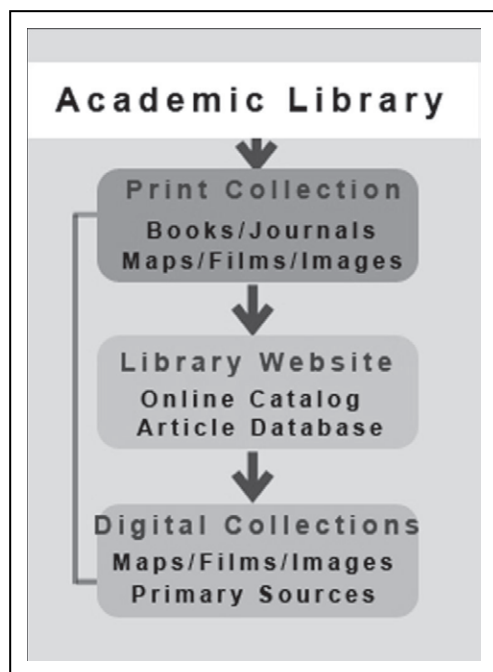
Figure 1. Academic library as a complex information system

them widely available to students and the general public. As demonstrated in Figure 1, academic digital library portals consist of multiple information systems, including online catalogs, licensed databases of electronic articles, e-journals, e-books, and full-text documents. Locally created digital collections represent only one of the components of complex academic digital libraries.

University students, teaching faculty, and researchers represent the intended primary audience of digital collections created by academic libraries. The use of digital resources by teaching faculty and the implementation of digital materials in online courses as well as campus-based classes has been explored in several recent research studies[4]. Unfortunately, very little empirical research has focused on the discovery of digital collections and students' interaction with digital resources in the context of their academic work. Despite two decades of digitisation efforts, the knowledge about users' perceptions of digital collections is rather scant.

The changing information behavior of the current generation of college students, often referred as the Net or Google Generation, or 'digital natives'[5] is the focus of an extensive survey research[6]. The studies confirm the widespread observation that students predominately use Web resources and search engines

for their academic research. The 2005 OCLC survey finds that 89% of college students use search engines to begin an information search, and although familiar with digital libraries, they feel that search engines fit their information seeking behavior better than physical or online libraries[7].

The most recent OCLC survey reports that the number of college students starting their information inquiry with a search engine slightly decreased (83%), but also indicates a shift to other online resource discovery tools with 7% of students beginning their search with Wikipedia and 2% with social networking sites. None of the surveyed students began their information search with a library website. However, when they discovered it (27%), often through a search engine, the library web site fulfilled their needs and they were more likely to return to it. The top reason for not using the library website was not lack of awareness, but rather 'the perception that other sites have better information'[8].

The information environment in which college students function and study has changed dramatically in the last two decades. Digital collections and other forms of educational digital libraries are part of a broader information landscape, often competing for users' attention with a multitude of alternative information systems. Perceptions of DLs need to be considered in a larger context since students and instructors don't use DLs in isolation, but in conjunction with other library and Web resources.

PRIOR RESEARCH ON USER PERCEPTIONS OF DLS

User perceptions of digital libraries, as of any other emergent information system, play an important role in their acceptance and effective use[9]. Research on DL perceptions builds upon the technology acceptance model (TAM), a well-established theory explaining user behavior in adopting new technology. Perceived ease of use and perceived usefulness, users' subjective assumptions of information systems, have been identified in TAM as critical indicators of users' intention to select and adopt a new system[10].

Usability and *usefulness* are interrelated aspects of applications and information systems that are necessary to ensure a system's functionality, to support user needs and tasks, and to provide a satisfactory user experience[11]. Usability is not a single property of a system, but rather a multidimensional concept that refers to multiple attributes, such as ease of learning and use, efficiency, memorability, error recovery, and user satisfaction[12]. ***Ease of use*** has been identified as a usability attribute critical to user acceptance of new systems[13]. The ideal of a usable system, as Mirel points out, 'is to be 'useful' by supporting the right model of people's work and 'easy to use' by disclosing an application's logic and operations.'[14] According to Mirel, ease of use is an important attribute at the initial encounter with the system, as usefulness matters throughout the entire interaction process.
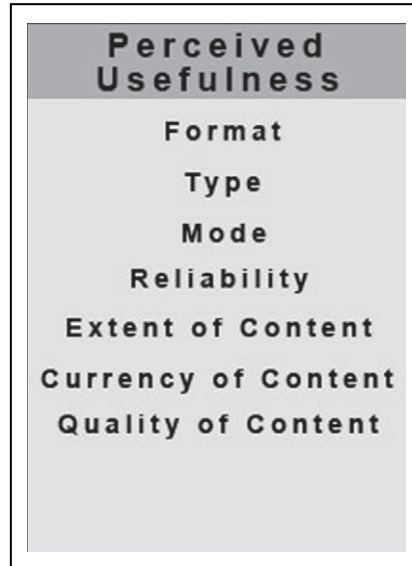
Figure 2. Perceptions of usefulness

In the context of digital libraries, ease of use has been the focus of usability models[15] and evaluation efforts in DL field[16]. Ease of use relates to system characteristics, especially the interface design. As Tsakonas and Papatheodorou[17] point out, 'ease of use is considered as a crucial attribute of DL interaction, especially in advanced systems.' Usefulness, on the other hand, is associated with the relevance of content, level and currency of coverage, format, and, reliability[18]. Usefulness is closely related to the role of DLs in supporting users' information needs, solving problems, and completion of tasks.

Perceived usefulness and *perceived ease of use* are users' subjective assumptions and opinions of the system and do not necessarily reflect objective reality. As demonstrated in Figure 2, perceived usefulness relates to the attributes of digital resources, such as format, type, mode as well as reliability, extent, currency, and quality. Those beliefs, however, influence users' intention to select the system and can play an important role in adopting it, especially if systems are new and part of emerging technologies. Perceived usefulness of an information system is understood as the extent to which a person believes that using the system will contribute to meeting his/her information needs or solving a problem. Potential users can believe that a system is useful, but at the same time be convinced that it is hard to use. Perceived ease of use is defined as 'the degree to which a person believes that using a particular system will be free of effort.'[19]

Perceptions of usefulness and ease of use are at the core of the technology acceptance model (TAM). Hong et al.[20] use the technology acceptance model (TAM) as a theoretical framework in investigating the factors that determine a user's adoption of digital libraries. Researchers examine the effect of a set of individual differences, such as self-efficacy, domain knowledge, and system characteristics on users' intentions to use digital libraries. Thong, Hong, and Tam[21] present a model of digital library user acceptance that is also based on TAM. The premise of this DL model is that user acceptance of a digital library is determined by users' perceptions of the system's usability. Mardis, Hoffman, and Marshall[22] examine digital library adoption in educational settings and extend the technology acceptance model to include contextual factors and barriers to use. The authors propose a new framework for understanding technology innovation in education and improving digital library adoption in schools.

Few recent case studies examine user perceptions of digital library systems in specific educational contexts or country settings. Tammaro[23] surveyed the perceptions of digital library users in Italy. Overall, she found positive attitudes towards digital libraries among the study participants. User perceptions, however, differed in regard to specific DL systems and types of digital resources. The results of the survey also indicate limited knowledge about features of DL systems and the lack of awareness of DL services. Sheeja[24] conducted a survey to examine the perceptions of undergraduate students of the DL system of the Cochin University of Science and Technology in India. The results of the study demonstrated that almost all students used the campus digital library for learning and were generally satisfied with its features and functionality. Both studies, however, focused on broadly understood digital library portals that included library catalogs and databases purchased from commercial publishers and vendors.

This study focuses specifically on unique digital collections created by academic libraries and cultural heritage institutions. It contributes to the growing area of research on user acceptance of digital libraries through a case study exploring students' and teaching faculty's perceptions of educational digital libraries. It extends the research on perceived ease of use and perceived usefulness of digital libraries by examining adoption of DLs in the context of other information resources that students interact with in the learning process.

METHODOLOGY

The study employed qualitative methodology and was designed as a case study. Two undergraduate geography classes at a Midwestern US university were selected for the study. Both classes represented a blended model of instruction with on-site lectures and online components available through the campus course management software. The selection of these classes was purposeful, as they

represented information-rich cases, characterised by extensive use of digital resources. Multiple qualitative data collection techniques were used to provide a thorough examination of the phenomena under study and to ensure reliability and validity of the research.

The study consisted of two phases: 1) semester-long field observations, accompanied by surveys and document analysis and 2) interviews with students and teaching faculty. Field observations in the classroom were focused on students' interaction with digital resources as well as on the characteristics of the materials used in lecture presentations and class discussions. The examination of resources was extended through the document analysis of syllabi, assignments, PowerPoint slides, selected student papers, and digital materials available as part of the course management system. Resource attributes, such as format, mode, source, and type were analsyed during this phase. Interviews, conducted in the second phase of the study, complemented the data gathered through observations and document analysis by exploring participants' practices, attitudes, expectations, and perceptions. Semi-structured interviews were conducted with 15 students, 2 professors, and 2 teaching assistants.

FINDINGS

The findings of the first phase of study demonstrate that digital resources were used extensively in both classes. The notion of digital resources includes objects in digital libraries as well as information materials available on the open Web. Students in the classes examined for this study were exposed to a wide variety of resource types in multiple modes, including images, maps, journal articles, datasets, video and audio clips, news sites, and educational and commercial websites. Visual resources – photographic images and maps – featured prominently in lecture PowerPoint presentations. Students also used images and maps in their projects and assignments.

The analysis of resources by their origin, however, indicated that almost all visual materials were located on the open Web. Students and instructors used the campus library website to locate articles and books, but relied heavily on the Google search engine for maps and images. The use of digital libraries as a source of learning resources was limited, especially if one considers the large selection of maps and images presented in both classes. Visual resources that students encountered in the classes were selected primarily from online sources. Educational digital libraries, although potentially offering relevant image and map resources, did not feature prominently in this selection.

Digital collections were undiscovered and underutilised in the classes observed for the study. This finding was particularly noticeable in light of the large amount of visual resources used in the classes for teaching and learning purposes. A collection of digitised maps was used only in one of

the classes. Academic digital library portals were used primarily for textual resources (journal articles), as indicated by one of the students, 'journal articles that are only available online. I got them off the library website. A lot of journal articles ... But I guess images not so much' (Student A, Interview). The students participating in the study, including teaching assistants, were not aware of digital image and map collections, not even those created by their local academic library. One of the teaching assistants admitted: 'here I'm a geography teacher and I don't utilise them [digital collections] at all' (TA2, Interview).

In one of the observed classes, the professor recommended a collection of digitised maps and asked students to use it for a project. For several students, this was their first encounter with a digital map collection, as pointed out by Student I: 'this was the first time I used them. I had no idea that they existed and that you could access those old maps online' (Interview). Students' experience in using the collection, once they discovered it, was very positive. They indicated that they would return and use it for other classes: 'my dealings with digital map collections are limited to this class, I even didn't know about this collection before this class. And now that I know it, [...] when I work on a project for a different class, that's somewhere I would go' (Student J, Interview).

The analysis of data gathered through interviews indicates that there is a relationship between perceptions of academic libraries and discovery of digital image and map collections.

This study finds that users' experiences in interacting with library information systems and their beliefs about academic libraries strongly affect their perceptions of DLs, and, in turn, impact their discovery and adoption of digital collections. The limited use of digital collections for teaching and learning in the case observed for the study was associated with perceptions of libraries as places of primarily textual print resources and of library information systems as difficult to use.

Perceived ease of use

Study participants reported that they found the library website difficult to navigate and insufficient in providing clues about the wealth of resources that it offers. Students' experiences in using the library website adversely affected their perceptions of digital collections. They did not perceive digital collections created by libraries as separate entities. As represented in Figure 3, digital collections were part of the library website and represented just another complex library information system.

Academic library websites were perceived as difficult to use, while the Web was viewed as easy. As Mirel[25] points out, ease of use plays a critical role in the initial encounter with the system. If users perceive a system as difficult, they may not even try to use it, despite its potentially useful content. This is especially true
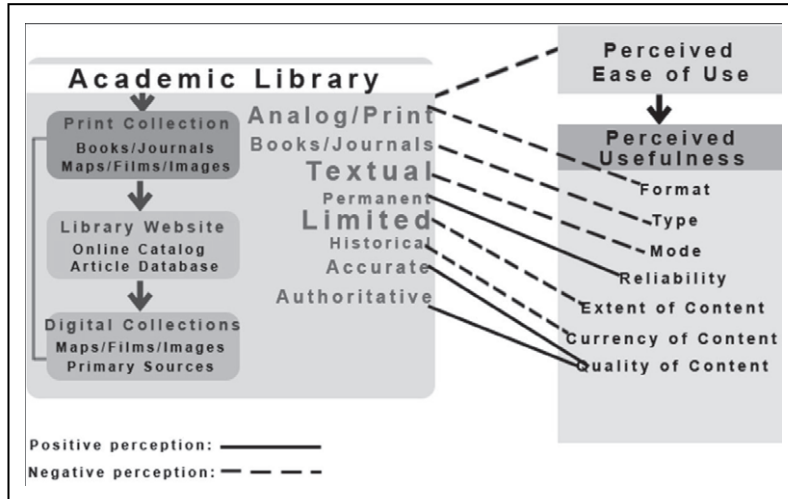
Figure 3. Perceptions of academic libraries

in a digital environment that offers other more usable alternatives. The difficulty of using a library information system relates to the fact that it consists of multiple elements, such as an online catalog, vendor-supplied article databases, and digital collections. Each of those components must be accessed separately and presents users with a different interface. In contrast, the initial encounter with the Web, for example in using Google Search, is not so overwhelming.

The complexity of library tools was perceived as a barrier to otherwise valuable content. Students' prior negative experience and perceptions of library systems as difficult to use had a negative impact on their intentions to try digital collections created by academic libraries. Student G admitted that he wouldn't attempt to use academic digital collections, even if he knew about them: 'to be honest with you, I probably would say: 'how would I even find it?' I probably wouldn't even try, you know, because, like I said before, it's hard to navigate library websites' (Student G, Interview). His assumption was that if libraries create digital collections, they probably would be difficult to use. In contrast, the participants perceived the Web as more usable and mentioned Wikipedia and Google image search as examples of easy to use systems.

Perceived usefulness

Study participants, including faculty, teaching assistants, and students, did not perceive academic libraries as a useful source of digital images and maps. The participants used a variety of the library online resources, such as the

library catalog and article databases, but when searching for images and maps, they turned to Google. Students and instructors in the study didn't associate libraries with visual materials and didn't expect libraries to have digital image collections.

As Figure 3 demonstrates, study participants perceived academic libraries primarily as repositories of scholarly textual materials, predominantly books and journals in the analog format. Academic libraries were not typically associated with visual resources. Although images were widely used for teaching and learning, they were treated with less reverence, especially if compared to text. Many of those perceptions proved to have a negative impact on the discovery and adoption of digital collections, especially that digital collections were are not perceived as separate entities, but rather part of the whole academic library 'package.'

In addition, libraries were perceived as places of limited resources and not as useful as the Web in regard to the extent of coverage, relevance, and currency of materials (see Figure 3). One teaching assistant explained: 'in my mind, the library is not going to have as much as is out there on the Web, so I would go to that first' (TA2, Interview). He considered the library as a source for historical materials, but would always search the Web for current materials. In contrast to libraries, the Web was perceived as a source of an infinite number of resources. The teaching assistant gave this as a main explanation for not using academic digital collections: 'there is this blind faith that everybody posted all these great maps out there and it is my job to track them down, so I've never relied on the library for those kinds of things' (TA2, Interview).

Interestingly, the participants were not always satisfied with the quality of resources that they located on the Web. Academic libraries, on the other hand, were associated with quality and reliability and, as the teaching assistant noticed, it would be great if libraries offered collections of visual materials 'because the library should be able to check the source, so those should be more reliable' (TA1, Interview). As demonstrated in Figure 3, study participants associated libraries with notions of accuracy and reliability and perceived libraries as an authority in providing intellectual control and in organising knowledge. Ironically, this perception of a library as a well-organised place with books seems to be a serious barrier in users' ability to discover digital collections created by libraries. Users simply won't come to the library web site to look for images if they don't expect libraries to have such materials.

Participants' perceptions of the usefulness of academic libraries in regard to format, type, and mode in relation to digital were mostly negative, while the Web was perceived as a source of unlimited number of current, visual and multimodal resources. On the other hand, stability and authority of Web resources tended to be viewed negatively, while for libraries those perceptions were definitely positive. As presented in Figure 3, the number of negative links that influence the

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perceptions of academic libraries, especially in relation to digital collections and visual resources, was significantly higher than for the Web. Study participants felt that academic libraries were negative in 6 categories.

DISCUSSION

The finding on the perceptions of academic libraries as repositories of scholarly textual materials echoes the results of OCLC survey on 'books' being a library brand[26]. This case study research also reveals similar patterns in college students' behavior in regard to beginning an information search with search engines. It supports the OCLC findings on low use of academic library websites and paradoxically, on a highly satisfactory experience, once collections were discovered[27]. This study also confirms prior research on the importance of perceptions, especially in regard to ***ease of use*** and ***usefulness*** to discovery and acceptance of digital libraries[28].

Ease of use has been recognised as a critical factor in the initial encounter with a new information system[29] and a major usability attribute[30]. Usability studies represent a major area of research and evaluation efforts in the digital library field[31]. The findings of this study underscore the importance of usability research, but also indicate that usability studies of DLs need to extend beyond a single system and must consider ease of use in the context of other components of online information systems. User perceptions of library systems as difficult to use stand out in contrast to other tools that students use to find resources online, such as Google Scholar, Google Image Search, or Wikipedia.

Perception of usefulness was identified in this study as a second and interrelated factor of users' intention to adopt digital collections. Academic libraries were associated with scholarly textual materials and the study participants did indeed use the library website to locate books and journal articles for their research. However, they did not perceive academic libraries as a useful source of digital images and turned to the Web when searching for visual resources. It is worth remembering that perceptions are users' subjective assumptions and do not necessarily reflect objective reality[32]. As Blandford[33] points out, digital libraries have great potential for education because they provide 'trusted information' in an environment where so much information is uncertain. The fact that this potential is not fully explored is ironic, especially in light of other findings of this study that indicate users' concerns about the quality and reliability of Web resources.

PRACTICAL IMPLICATIONS

There is no doubt that academic libraries should be doing a better job at promoting their unique digital collections to address the issues of limited use

and to change users' perceptions of libraries as repositories of textual print materials. The issue, however, is larger than the lack of promotion efforts on the part of libraries. As Brown and Duguid[34] note, humans aided by digital technology create more information that they can process. In an environment where information sources are abundant and compete for user attention, libraries need better strategies and digital management tools to deliver their content to users. Paradoxically, we need to employ more digital tools to manage the exponential growth of information.

First, academic libraries need to acknowledge the fact that the library website is not a primary stop for students and faculty in their information quest. As indicated in this case study and demonstrated on a much larger scale in the OCLC survey, college students do not begin their search on the library website[35]. These consistent findings, alarming to librarians and DL developers, are also an indication of the changing information landscape and a new position of academic libraries. In the print environment, academic libraries were a primary if not the only source of scholarly materials. With the emergence of the Web, libraries lost not only their primary role, but also a visible and unique identity[36].

The wealth of scholarly materials in academic digital library portals, including digital collections of unique visual resources, maps, and primary sources represent great, but often untapped potential of resources for teaching and learning. Academic libraries need to develop strategies and digital tools to be visible in spaces where college students search and interact with information – course content management sites, search engines, Wikipedia, and social networking sites. Academic libraries should also increase their efforts in metadata harvesting and search engine optimisation to expose their unique digital collections on the Web. Search engine optimisation and other technical tools are currently available to ensure that digital collections are indexed by Google and other search engines.

Moreover, libraries need to address the usability of their websites and provide more integrated and seamless resource discovery tools that allow users to search across multiple online components. In fall 2008, when this case study was conducted, federated search tools available through library websites still had rather limited functionality. They were capable of conducting searches across multiple article databases but excluded library catalogs and digital collections. However, the new tools that are currently under development, 'Next-Gen Discovery Interfaces,' as Breeding[37] describes them, facilitate a more integrated access to all library recourses, including digital collections and other locally created repositories. These new discovery tools should be able to increase the exposure of visual resources and change the perception of libraries as places of textual materials.

CONCLUSION

Digital libraries are relatively new phenomena and, like many new and emergent information systems, face challenges of discovery, acceptance, and utilisation. Digital collections of images, maps, and primary sources offer a wide array of unique and potentially useful digital resources for teaching and learning. In the cases observed for the study, however, the potential of digital collections was not fully explored. The results of this study indicate a relationship between perceptions of academic libraries and discovery of digital image and map collections. This study finds that user perceptions of usefulness and usability, especially perceived ease of use, play an important role in user intentions to adopt and use digital collections for academic learning and teaching.

By examining the use of digital library resources in the natural classroom setting and exploring teaching faculty and students' perceptions in a broader information context, the study provides a new perspective on research of user acceptance of digital libraries. With empirical evidence of actual practice, the study contributes to a better understanding of perceptions that affect the way users adopt and use educational digital libraries. Use of educational digital libraries represents a new area of research and their untapped potential requires further investigation.

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