Closing the Gap: Interdisciplinary Perspectives on Research and Education for Digital Libraries

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Abstract. Two major themes continue to be a subject of discussion when dealing with digital libraries: how should the education programs in LIS (Library and Information Science) schools be changed or updated in order to provide the needed knowledge (skills ?) for librarians in the digital age and, closely related, how could the three major memory institutions (libraries, archives and museums) define common educational curricula for professionals in the three domains, now that the digital age is blurring the boundaries between the three profession. In this paper we will present some considerations about the first topic, in order to share the experience gained through the organization and the participation in five events, having as theme the educational needs of the new librarians and the possible synergies of research and education in the field of digital libraries. It is hoped that it can serve as a further stimulus for discussions and for the definition of possible common actions in the digital libraries community.

Keywords: digital libraries, education, research in digital libraries, information professionals.

1 Introduction

Computer Science and Library and Information Science communities practice and do research differently and as a result their outcomes such as curricula, projects results, digital products and publications are different. But digital libraries and the things they bring with it, such as curation of digital collection, interoperability, metadata, which are prompting a move from a "Library model" to a "Digital Library model" are pushing to close the gap between the two communities. This paper examines some of the theoretical differences between the two communities as well as the experiences of sharing expertise and how the Digital Library model is contributing to this overlap and how education and research on digital libraries are evolving to support the new synergies.

In a simple view, the notion of Digital Libraries involves some combination of multimedia content and computer programs. It has unique advantages such as very low marginal costs for creation, storage, management and speed access and distribution but also involves the disadvantage of increased legal obstacles for access to information and the weakness of economic sustainability. Research in "Digital Libraries" has been going on now for over 15 years (even though there is not yet a general

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agreement on the exact meaning of the term), leading the way to research also in fields of memory institutions. As a result the Digital Library Universe is a very complex one, encompassing a number of different technologies, disciplines and application fields. In addition to that, research in Digital Libraries can be tackled from many different perspectives and angles. Digital Libraries are, for example, information systems and their technology can be researched as such; but they are also organizations and they can be researched also in that respect; they are arenas for the study of information seeking behaviour and for social processes such as learning and knowledge sharing, which can be another dimension of research; they are collections of content that need curation (collection, description, preservation, retrieval, etc); they are social institutions with a social mandate, and as such they are affected by social, demographic and legal issues. Interdisciplinary perspectives cover a wide range of digital libraries management issues and research findings offer insight into educational curriculum and real world practice.

From this multifaceted perspective it appears that Digital Libraries continue to be a new topic in existing research fields, and education has to take into account this interdisciplinary and multidisciplinary aspect. Experts from the two communities should offer their views in the operational, managerial and strategic challenges that face digital libraries managers and researchers now and in the next decades.

2 Literature Review

Taken in isolation from each other, Library and Information Science and Information Technology approaches have a number of constraints. Coleman [7] noted that for too long, LIS schools have responded to the impact of IT in the workplace by simply adding to the existing LIS curricula courses such as Systems Analysis and Design, Database Fundamentals, Human Computer Interaction, and so on. The IEEE Technical Committee on Digital Libraries (TCDL) promotes research in the theory and application of digital library technologies. Issues of interest include: Searching and browsing; Indexing for multimedia objects; Authoring, Scripting and capturing systems; Resource discovery; User interface; Collaborative research; Information representation; Intelligent agents; Workflow; Telecommunication and networking; Interoperability; Scalability; Content storage and distribution; Protection of intellectual property and user privacy; and Accounting, billing and payment systems. The Computing Curricula [8, 10] outline Digital Libraries as an elective area with topics such as digitization, storage and interchange, digital objects, composites and packages, metadata, cataloguing, author submission, etc.

Another approach has been to merge; often the merger is with larger departments such as Communications and Education and less often with IT-intensive ones such as Computer Science [12]. Coleman [7] concludes that anecdotal evidence suggests that both approaches leave novice LIS graduates with overwhelming feelings of information overload, the impression that the library profession is in chaos, and a sense that there is no real core LIS disciplinary knowledge beyond the service ethic, descriptive and procedural knowledge of information resources and their use.

Tennant, a professional librarian, discusses [21] the shortage of digital librarians and explains why public service LIS professionals must become ”tech-savvy”. How can you offer good public service, he asks, if you don't know the "universe of possibilities"? A digital librarian should distinguish ASP from PHP (two different ways of creating dynamic web pages), and be able to understand and evaluate a variety of information technologies for their potential use. Are librarians still needed? Google has become a nearly omnipresent tool of the Internet, with its potential only now beginning to be realized. Users are more and more starting their research from Google page and librarians can become an outdated species. Miller and Pellen [14] comprehensively explore the path libraries need to travel to benefit from the search tool, rather than being overwhelmed and destroyed by it.

Over the past years, digital content has been generated faster than our ability to manage, preserve and disseminate it. Some of the current efforts in research have been focused on improving our capacity for better managing repositories, for preservation and for building infrastructures for searching, accessing and re-using networked digital resources. Bruce [2] affirms that the intellectual and technical issues associated with the development, management and exploitation of digital libraries are far from trivial and we are still a long way to consider it solved. What is needed is a coordinated approach to digital library research combining expertise of LIS and Computer Science with applications such as e-learning, e-government, e-science and digital humanities. This will make it possible to make significant progress towards semantics based multimedia knowledge networks.

3 Methodology

While interdisciplinary convergence is needed, it will not suffice in overcoming all the constraints. We want to share here our experiences of the participatory nature in Digital Library curriculum design and discuss how, as a team with different backgrounds (Humanities and Computer Science, Education and Research), we developed a common understanding using a “workshop model” which has been run and iteratively refined at five major international conferences, involving over 200 participants. The cooperation started with a workshop held in 2005 in Parma with the title “Information Technologies profiles and curricula for libraries”, jointly organized by the DELOS Network of Excellence, the European Library Automation Group (ELAG) and the University of Parma International Master in Information Studies [11]. The second event was in 2008, with a panel organized at the ECDL Conference in Aarhus, having as subject: “The Web versus Digital Libraries: time to revisit this once hot topic” [6]. In November 2010 the DL.org project joined forces with the International Master “Digital Libraries Learning” (DILL, a Master Programme funded by the EC's Erasmus Mundus program), organising a seminar in Parma with the title “Education and Research in Digital Libraries” [9]. In 2011 a Workshop with the title “Linking Research and Education in Digital Libraries” was held at the TPDL Conference in Berlin, as a continuation of the previous one [5]. Finally, a last workshop with the title

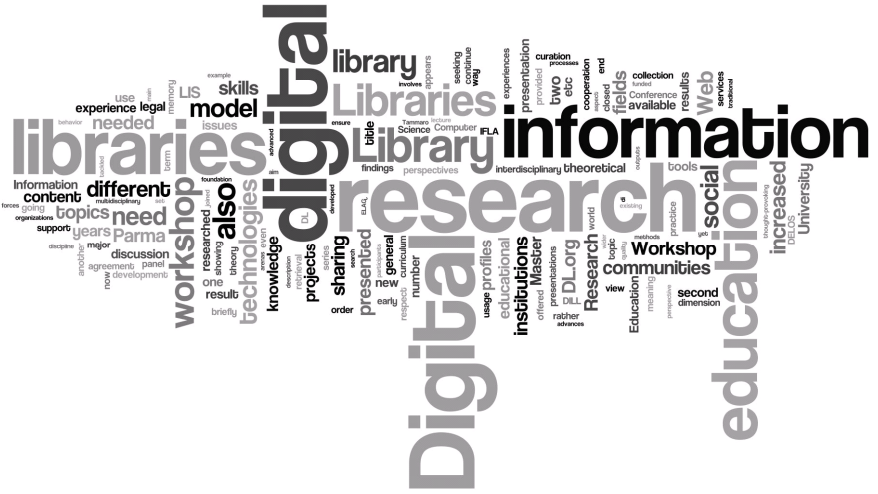

Fig. 1. A tag cloud for Research and Education in Digital Libraries

"Can Research help Education in Digital Libraries?" was organized, in connection with the LIDA 2012 Conference in Zadar [1].

In section 4 we will briefly present the main aim and outcomes of the first two events, where the focus was mostly on understanding the educational needs of future librarians, to cope with the increasing need of skills in Information Technology. In section 5 we will briefly describe the other three events, where the focus was mostly in trying to understand the possible sinergies of a closer cooperation between Research and Education in the field of Digital Libraries.

4 Professional Profiles for Digital Library

Since the impact of IT on all disciplines will only continue to increase, also the interest for interdisciplinary curricula development is increasing. A new approach should view curriculum development intellectually at the unit level (what topics and learning objectives/competencies are common across related disciplines) and how best to facilitate this development for professional graduates. At the very least, such approaches could use research findings about interdisciplinary learning to improve the problem solving and competencies of graduates.

The Workshop "Information Technologies profiles and curricula for libraries", held in Parma in 2005, wanted to identify and define the IT profiles and skills needed in libraries and information centres, and to propose a set of educational actions that could result in making those skills available in the short medium term. A first set of presentations was on the theme "Relationships and cooperation between IT education and LIS schools", which provided an overview of the current position in educational issues with respect to information technologies for libraries and recent trends in research on digital libraries. A second set of presentations was introducing and

discussing the general theme of “Competencies and Profiles”, devoted to the contributors' own experience and case studies of skills and competencies. Both sets of presentations were supplemented by a process of feedback through a series of parallel breakout sessions and workgroup discussions, which were then reported back and discussed in plenary sessions on the second day.

During the workshop two “new” professional profiles needed in a digital library were discussed. The first profile was that of a “digital librarian”, with a deep knowledge of the (digital) content of the library, and enough knowledge of IT tools to allow him/her to” curate” (the term was not yet trendy at that time) the collections of the library. The second profile was that of a “system librarian”, with a good knowledge of Information Technologies and Architecture, and enough knowledge of library services and management to allow him/her to formulate the requirements for a Digital Library Management System and to use and manage the system once that it was operational.

In the second event, a panel at ECDL 2008, it was discussed the relationships between the Web and both the traditional and the digital libraries. To stimulate discussion, the view of one camp was claimed to be that since “all” the information was available on-line, the use of smart search engines and clever software tools would allow the Web to provide all the information (and the services) needed by an information seeker. The view of the other camp was that the value of information was not just in its sheer quantity, but was rather in the organization and the quality of the information made available, and that could never be accomplished by “programs”. Some years later, with the continuous increase of the information available on the Web and the advances in search engine technologies, an even more radical question could be raised, questioning the need of libraries at all, whether digital or not. More and more it appears that when there is an information need, everybody (including scholars) is first “googling” on the Web to find the desired information, and it is not known how many information seekers will continue by accessing also some (digital) libraries in order to satisfy their information need. During these years however, digital library technologies have supported the transition of libraries from traditional to digital, and those technologies are today mature enough to support not only the availability of the library content online, but also the provision of advanced services for library users.

At the end of the panel the position that gathered most of the consensus was the one supported (not surprisingly) by Google, The main mission of a web search engine should be to provide access to the ”world’s information”, and make it universally accessible and useful, whereas the main mission of a digital library should be to organize the information needed and used by one or more specific user communities and make it easily accessible and useful to those communities. The difference in mission implies therefore a difference in scale (the web is measured in billions of pages, a digital library is measured, at best, in millions of documents), a difference in coverage (as broad as possible in the web, as deep as possible in the library) and a difference in services, i.e. how to add value to the content of the library (precision and general services in the web, completeness and specific services for a user community in the library). The web and the digital library have therefore similar and complementing

missions, and they should take advantage of each other, and focus on the delivery of useful and relevant (web) services to their user communities.

What emerged from these first two events was the identification of three main profiles at the operational level of a library. Two of them, namely the digital librarian and the system librarian, have been mentioned before , while the third one, that could be called the "end-user librarian", is a profile with a deep knowledge of the information needs and applications of the selected user community. The end-user librarian should be able to provide input to the digital librarian on one side and to assist the library users on the other, by providing reference services (possibly using web search engines) and assistance in the use of the new functionality (possibly) made available by the digital library, such as annotations and collaboratories.

5 Research in Digital Library

In 2010 the International Master DILL (DIgital Libraries Learning) and the European project DL.org organized together a one-day seminar ("Research & Education in Digital Libraries"), as a forum for discussion between the research communities participating in the DL.org activities and the communities of Digital Library education in Europe, with the aim of starting a dialogue about research and education in digital library and to explore ways for a closer cooperation between those communities. DILL is a two-year international master program (which was funded until 2011 by the European Union under the Erasmus Mundus program) that is bringing forward the idea of interdisciplinary education in Digital Libraries by providing to its students courses which span some of the different aspects underlying digital libraries. DL.org (now ended) was a project funded by the European Union under the 7th Framework Program to bring forward a research program focussed on interoperability in digital libraries, which means that research should consider not only the technical dimension, but also other dimensions that might be affected by interoperability issues (e.g. policy, quality, user profiles, legal aspects).

Among the main accomplishments of the DL.org project there is the completion of a conceptual model for Digital Libraries [3] (initiated by the DELOS Network of Excellence), which includes the three roles (profiles) of library professionals mentioned above, and which has been widely used in DILL and in other courses and Summer Schools addressing the educational needs of library professionals, to establish a common view of the entities and the concepts underlying the "Digital Library Universe".

The stated objectives of the seminar (only partially attained) were:

- Start discussing how to implement a European scale mechanism for exchanging, sharing and integrating research results into education in digital libraries
- Start defining research topics suitable for PhD students to ease the integration of research done in European projects and research done in Universities
- Discuss how the interoperability research results of DL.org can be transferred to education in digital libraries

The discussions prompted by a number of interesting presentations brought into evidence a wide range of issues, going from the need to transfer research outcomes into learning material, to the need for DL professionals to have hands-on experience with IT tools and services, to the need to work towards stronger theoretical foundations for digital libraries. A practical result was the identification of a few research topics for DILL Master Thesis and the opportunity for internships for the DILL students attending the workshop.

In 2011 DL.org and DILL continued their cooperation organizing a workshop ("Linking Research and Education in Digital Libraries") in connection with the conference TPDL 2011. The aim of the workshop was to bring forward the discussions already started at the previous events, namely how to better exploit the results of research for education in Digital Libraries, or more generally, for education to "information workers". As briefly mentioned at the beginning, all professionals working in the so-called "memory institutions" (libraries, archives and museums) are increasingly facing the need to reconsider their educational needs in order to maintain the traditional leadership in the cycle of knowledge creation, distribution and preservation. The increased availability of digital information made possible by the Web is blurring the boundaries between those institutions and is transforming the respective professionals in a more general role of "information workers". The main thread of discussion was a critical review of the roles of the information professionals, considering not only the impact brought by the advances in the technical dimension, but considering also other dimensions such as policy, quality, user profiles, legal aspects, etc.

A number of interesting topics were presented and discussed during the workshop, such as the need for a theoretical foundation in order to transform the "librarian profession" into a "librarianship discipline"; the possibility of using a "conformance checklist" to assess the conformance of a digital library with the conceptual model proposed by DL.org, showing how the checklist could provide the basis for defining a set of topics needed in digital library education. A discussion about the skills needed by a professional in order to evaluate a digital library, focusing more on the organizational and interpersonal skills rather than the technical ones, was useful in highlighting a (different) set of topics needed in digital library education. Several examples advocated the early involvement of students into research projects requiring skills both in Library and Information Science and in Computer Science. An interesting perspective introduced the notion that a change in terminology, when going from the library world to the world of the Web and Linked Open Data (e.g. from "catalogue" to "graph", from "document" to "aggregation"), actually implies a complete re-thinking of the meaning of all those terms, and therefore also a re-thinking of their educational aspects.

A concluding panel provided additional views and experiences in education in digital libraries. At the conclusion of the panel and the of workshop there was a general agreement that information professionals, given the increased use of Web technologies for knowledge dissemination and for collaboration, definitely need an increased education in the usage (and development) of interactive tools and services to

facilitate their activities as information professionals. It was unclear (and it was left open) how and where to draw the line between increased education in Computer Science in general, and increased education in the usage of advanced applications and tools available for memory institutions.

In 2012 DL.org and DILL organized together another event in this series, namely a panel ("Can Research help Education in Digital Libraries ?") in connection with the conference LIDA 2012. As in the other events, the main aim of the panel was to explore how the research activities and the educational activities can interact together at an earlier stage, in order to benefit each other from a better knowledge of the respective needs and objectives. The panellists were chosen so as to represent both sides of the matter. The introduction to the panel presented the following considerations, as a way to start a debate both among the panellists and with the audience.

It is becoming more and more clear that the pace of advancement of the technologies underlying and supporting Digital Libraries and the services that they provide is not matched by similar advancements in the educational curricula leading to "Digital Librarianship". Over the last 15 years Digital Libraries, or more generally the "Memory Institutions", have seen a significant level of research in many of the fields that in one way or another are related to the production, description, collection, preservation, retrieval and usage of digital information. In many cases the outcome of those research activities has resulted in tools and technologies (e.g. interoperability of data at the semantic level, natural language processing, automatic analysis and classification of texts, building of multimedia collections) which allow a more effective way of providing the traditional services of the memory institutions.

In parallel with those developments, the educational curricula of librarians, archivists and museum curators have been (slowly) updated to reflect the changes in the professional environment, but those changes in the curricula often appear to be dictated more by the need to "run after" the technology, rather than a deep re-thinking of the educational needs of the memory professionals, resulting just in the increase of the "technology component" of the curricula.

The presentations and the discussions during the panel somehow confirmed those initial considerations, especially when looking at some of the emerging areas of interest for the publication, access and re-use of scientific material. For example, there is an increasing need to publish and make accessible experimental data (e.g. data banks, data sets of results, methodologies and workflows), which implies for a library the ability to manage new and different types of content; there is an increasing need to curate, collect, aggregate and make available data coming from many different sources, which implies for a library the ability to manage repository registration and validation, policy definitions, representation of ontologies and mappings, etc.; there is the need to provide access to different "views" of a digital library, which implies for a library the ability to provide "virtual digital libraries" on demand. Very few of the participants in the panel and the audience seemed to have "standard" curricula covering those emerging topics.

6 Conclusions

Coleman [7] writes that often the starting place for designing an interdisciplinary course involves an eight-step process to interdisciplinary course and curriculum planning:

1. Assemble an interdisciplinary team;
2. Select a topic;
3. Identify disciplines from which the course needs to draw;
4. Develop the subtext for the course (subtext is the abstract issue or issues which form the substantive topic of the course);
5. Structure the course by identifying the conceptual glue that holds it together, keeping in mind not only what is taught but to whom;
6. Select the readings;
7. Design the assignments;
8. Prepare the syllabus. The syllabus must specify what disciplines are included and why.

Through the series of events described in the paper, the interdisciplinary collaboration between Library and Information Science and Computer Science has been able to achieve a preliminary understanding of steps 2 and 3 and (to some extent) 4 of this process, focusing on the Digital Library domain. The events were useful for identifying the state and characteristics of education and theoretical research in Digital Library and confirmed the understanding that both theory building and theory use in education are intertwined, in order to construct a cohesive body of knowledge in the field. The results confirm that the degree of interdisciplinarity within Digital Library has increased and is growing. Further research is needed to evaluate this and other strategies based on the recognition of a wider range of channels for communication of research to practice and education. The events showed a tendency to converge into a few subfields, such as digital curation, information seeking and Digital Library use, information retrieval in the Web. However, the declining share of theoretical developments are showing to Library and Information Science researchers the urgency and the importance of continuous and creative research in that field, in collaboration with Computer Science researchers.

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