A Framework for Knowledge Management Education in Digital Library Learning

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Abstract
Knowledge management (KM) is one of the most engaging subjects in the modern knowledge-based economy, and many academic and professional disciplines have adopted KM education into their course programmes. Library and Information Science (LIS) is another academic discipline that has a lot to gain by incorporating the principles of KM. This paper aims to suggest a modular approach to KM education in the realm of Digital Library (DL) learning. This paper is based on a review of the scientific literature of the field, and a mini-case analysis of the ‘International Master in Digital Library Learning’ (DILL) programme – which includes a module on ‘Information and Knowledge Management’ (IKM). The study describes emerging notions of DL and KM, and explores the current state of DL learning and KM education in Library and Information Science (LIS). It analyses a mini-case, and shows that the IKM module of DILL comprises dimensions of content, context, people, process and technology. Finally, this paper proposes a framework of KM specialization in the DILL programme which consists of four modules based on the four major perspectives of KM; information, technology, business, and human.

Keywords
Knowledge management (KM), KM education, Digital library (DL), DL learning, Library and information science (LIS)
Introduction

The overwhelming growth of digital technologies and their applications in library science and information systems have transformed traditional scope of librarianship into digital librarianship. Although the history of digital libraries is now approximately twenty years long (Candela, Castelli, and Pagano 2011), the concept can be traced back to Licklider’s (1965) ‘Library of the future’ and Lancaster’s (1978) ‘paperless library’. By the end of the 1980s digital libraries were barely a part of the landscape of librarianship, information science, or computer science, but by the end of the 1990s, research, practical developments, and general interest in digital libraries exploded globally (Saracevic and Covi 2000). Emerging trends DL, as well as the existing shortage of professional librarians with the expertise in digital technologies have demanded for learning digital librarianship. A number of studies have examined KM education for DL as a sub-field of Library and Information Science (LIS) curriculum (Spink and Cool 1999; Saracevic and Dalbello 2001; Pomerantz et al. 2006; Ma, O’Brien and Clegg 2006, 2008).

Another significant innovation of the 1990s was the emergence of knowledge management (KM). The early emphasis in KM was on information systems, and then the focus shifted towards organizational development, intellectual capital management, and competence management. Towards the end of the 1990s, social learning, organizational sensibility, and systemic innovation and change management became prominent themes in KM (Tuomi 2002). Thus, KM has emerged as an interdisciplinary field of education, research, and professional practice in a number of disciplines such as information systems, business and management, library and information science, human resource management, cognitive science, and more.

LIS is the field that is most directly affected by the emergence and growth of KM. LIS is historically linked to KM in the sense that the core of LIS is managing explicit knowledge and data. Recent studies have confirmed that LIS is the leading discipline for academic programmes in KM (Saito 2007; Sutton 2007). Although a number of studies have suggested new types of course content and curriculum in KM for LIS (Reardon 1998; Todd and Southon 2000; Chaudhry and Higgins 2003), none has developed a framework of KM education for DL. This paper hopes to minimize this gap of research.

Objectives of the Study

The main objective of this paper is to develop a framework for KM education in DL learning. The specific objectives are:

- To describe the emerging fields of DL and KM;
- To explore the current state of DL learning offered by LIS schools;
- To examine LIS-based KM academic programmes;
- To analyse the “Information and Knowledge Management” (IKM) module of an ‘International Master in Digital Library Learning’ programme; and
- To suggest a modular approach to KM education in DL learning.

Methodology

The methodology used for this paper is a review of the scientific literature, followed by an analysis of a mini case, ‘International Master in Digital Library Learning’, and the authors’ own viewpoints. The review includes studies related to digital libraries and knowledge management, specifically the educational aspects of these two emerging fields. We have selected the ‘International Master in Digital Library Learning’ programme offered by Oslo University College (Norway) in conjunction with Tallinn University (Estonia), and Parma University (Italy) as the case under consideration. The reasoning behind selecting this programme is that its international nature and the inclusion of KM content in it will accord a more holistic review. The case analysis
is based on the data available to the public in the programme homepage, and an e-mail interview of two key people related to the programme.

**Digital Library (DL) Learning**

*Digital library: an overview of the concept*

Digital libraries can be viewed from different perspectives; Fox et al. (1995) observes that the term digital library implies different things to different people, ranging from the simple act of transferring traditional libraries to an online medium to digital libraries with a space in which people communicate, share, and produce new knowledge, and knowledge products. In the first textbook on the topic, Lesk (1997) characterizes digital libraries as “organized collections of digital information”, while Miksa and Doty (1994) suggest that a digital library might well be called a digital information system, or a digital publishing system. Arms (2000) defines a DL as a managed collection of information, with associated services, where information is stored in digital formats and is accessible over a network. In fact, DL systems have greatly evolved since their earliest appearance. According to Candela, Castelli, and Pagano (2011), modern digital libraries have become complex networked systems able to support communication and collaboration among different worldwide distributed communities, dealing with digital objects. Such objects comprise not only the digital counterpart of printed documents, but also images, video, programs, and any other kind of multimedia objects a community may define as appropriate to its working and communication needs.

**DL education in LIS**

In recent years, education in DL has increased in graduate level curricula at LIS schools. Chu’s (2006) study confirms that one of the most frequent new course titles in LIS schools is ‘Digital Libraries’. In the late nineties, Spink and Cool (1999) identified 20 institutions, including 12 in the USA, 2 in Australia, and 1 each in Brazil, Canada, Malaysia, New Zealand, Singapore, and the UK, that offered DL education. A majority of the institutions (16) offering DL courses were within Library and/or Information Science related departments. Two years later, Saracevic and Dalbello (2001) found that, of the 56 LIS programmes accredited by the American Library Association (ALA), 47 (89%) included DL in some form or to some degree in their curriculum. Liu’s (2004) survey of DL education identified 20 of the 36 LIS schools as having ALA accredited DL programmes, and the rest of the programmes were computer science or LIS programmes in Europe, South America or Asia. The subject analysis of online course syllabi based upon the occurrences of topics, offered by 30 LIS schools in 12 countries, shows that there exists some emerging qualifications in LIS programs indicating new roles for librarians in the web and digital environment (Kousha and Abdoli 2008). This study, however, finds a remarkable gap between required job qualifications and LIS course contents in “digital libraries” with only 0.9% of subject occurrences in LIS programmes.

IFLA World Guide to Library, Archive and Information Science Education (Schniederjurgen 2007) enlisted 1,033 LIS-related schools/departments. The analysis of only available course contents of 433 schools/departments shows that the title “digital library” appears in 94 programmes with high concentration at postgraduate level 65 (69%), followed by undergraduate 25 (27%), diploma 2 (2%) and certificate course 2(2%). Ma, O’Brien, and Clegg’s (2008) study mentions that by the end of 2006 (based on module titles shown on-line), 28% (5/18) of all universities with accredited programmes by CILIP (the Chartered Institute of Library and Information Professionals) in the UK and over 60% (34/56) of all library schools accredited by ALA in the USA and Canada are offering specific DL education.
**DL course content and curriculum areas**

The content of DL courses varies from school to school depending on the concept of DL as adopted by the schools, and the discipline within which the schools are offering DL education. One of the earlier studies suggested seven major areas of DL curriculum: theoretical and historical foundations; technical infrastructure of the digital library; knowledge organization in digital libraries; collection development and maintenance; information access and utilization of digital libraries; social, economic and policy issues; and professional issues (Spink and Cool 1999). The DL has a connection to KM, and hence, the content of DL suggested by Saracevic and Dalbello (2001) includes KM comprising, among others, standards, document structure

### Table 1: Topics in digital library education

<table>
<thead>
<tr>
<th>Module</th>
<th>Core Topics</th>
<th>Related Topics</th>
</tr>
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<tbody>
<tr>
<td>Module 1</td>
<td>Overview</td>
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<tr>
<td>Module 2</td>
<td>Collection Development</td>
<td>a) Digitization; b) Document and E-Publishing Mark-up</td>
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<tr>
<td>Module 3</td>
<td>Digital Objects</td>
<td>a) Text Resources; b) Multimedia; c) File Formats, Transformation</td>
</tr>
<tr>
<td>Module 4</td>
<td>Information/Knowledge Organization</td>
<td>a) Metadata, Harvesting, Cataloguing; b) Ontology, Classification, Categorization; c) Vocabulary Control; d) Bibliographic, Bibliometrics, Webbiographics</td>
</tr>
<tr>
<td>Module 5</td>
<td>Architecture (Agents, Mediators)</td>
<td>a) Interoperability; b) Sustainability; c) Interface Design, Usability Assessment; d) Search Engines &amp; IR; e) Identifiers, Handles; f) Info Summarization, Visualization; g) Recommender System; h) Applications; i) Web-publishing; j) Security</td>
</tr>
<tr>
<td>Module 6</td>
<td>Space (Conceptual, Geographic, 2/3D, VR)</td>
<td>a) Storage; b) Repositories Archives</td>
</tr>
<tr>
<td>Module 7</td>
<td>Services (Searching, Linking, Browsing, Annotating, etc.)</td>
<td>a) Information Needs, Relevance, Evaluation; b) Search Strategy, Information Seeking Behaviour; c) Reference Services; d) Routing, Community, Filtering; d) Sharing, Networking, Interchange</td>
</tr>
<tr>
<td>Module 8</td>
<td>Archiving, Preservation, Integrity</td>
<td>—</td>
</tr>
<tr>
<td>Module 9</td>
<td>Project Management</td>
<td>a) DL Development for a Specific Domain; b) DL Project Examples; c) DL Evaluation; d) Legal Issues; e) Cost/Economic Issues; f) Social Issues; g) Future DLs</td>
</tr>
<tr>
<td>Module 10</td>
<td>DL Education &amp; Research</td>
<td>—</td>
</tr>
</tbody>
</table>

*Source* Adapted from Pomerantz et al. (2006)
and electronic texts, preservation, and community building and social context as the contents of digital library courses offered by LIS schools. Liu (2004) proposed a DL curriculum covering the areas of history and definitions of DL, building and organizing DLs, integrating and interoperating digital information, policy and legal issues in DLs, interface design and services, DL evaluation, collaboration and global perspectives on DLs, and the future of DLs in society. A more comprehensive and a modular approach of the DL curriculum was recommended by Pomerantz et al. (2006) which included 10 modules with both 'core' and 'related' topics in DL as shown in Table 1.

**Education for Knowledge Management (KM)**

The concept of KM

Although there is no commonly agreed upon definition of knowledge and its management, it is generally agreed that there is a continuum of data, information, and knowledge. Thus, KM deals with the management of data, information, and knowledge. According to Abell and Oxbrow (2001), KM is the creation and subsequent management of an environment which encourages knowledge to be created, shared, learnt, enhanced, and organized for the benefit of the organization and its customers. Southon and Todd (2001) explored a wide spectrum of notions regarding KM such as:

- A renaming of information management,
- An extension of information management,
- Very broad programme of which information management was only a part, and
- A poorly defined and problematic phenomenon.

Southon and Todd (2001) further identified some characteristics of KM contrasted substantially with those of information management (IM). KM is described in terms of people-centred characteristics: sharing, understanding, intellectual capital, enabling people, interacting, using—in essence, an ‘organizational being’ construct; whereas IM is described with largely technical, service-oriented terms: organising information, processes and systems, access to and provision of information retrieval, an ‘organisational doing’ construct. Thus, IM is concerned with the management of only explicit information and/or knowledge, while KM is related to both explicit and tacit knowledge.

KM education in LIS

The academic side of KM is multifaceted, and hence Sutton (2007) raised the question, “where does KM fit in the academy?” He, however, finds no boundary or restriction for the departments,

<table>
<thead>
<tr>
<th>Coordinating school/department</th>
<th>Master’s in KM</th>
<th>Concentration in KM</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Library and information science</td>
<td>11</td>
<td>3</td>
<td>14</td>
</tr>
<tr>
<td>Computer science, information systems</td>
<td>7</td>
<td>4</td>
<td>11</td>
</tr>
<tr>
<td>Management, business, public administration</td>
<td>4</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>Engineering</td>
<td>3</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>Education</td>
<td>3</td>
<td>n/a</td>
<td>3</td>
</tr>
<tr>
<td>Total</td>
<td>28</td>
<td>12</td>
<td>40</td>
</tr>
</tbody>
</table>

schools or faculties where KM can be taught or practiced.

Analysing 40 KM Master’s programmes, as mentioned in Table 2, Saito (2007) identified that the highest number of programmes (14) were offered by the schools of LIS, followed by the schools of computer science and/or information systems (11), Management/business/public administration (8), Engineering (4), and Education (3). The result of a survey of homepages (only in English) of 300 LIS schools from around the world conducted by Roknuzzaman and Umemoto (2009) shows that only 37 (12.3%) schools offered KM education, ranging from simply one course or module in KM to full-fledged Master’s or Doctoral programmes. A year later, these authors extended their survey and found that out of 600 LIS schools, 106 (17.7%) schools provided 140 KM programmes or offered KM in courses in different degree programmes (Roknuzzaman and Umemoto 2010). The survey also shows that the diffusion of KM education was high at a master’s degree programmes, offering 65% of the KM programmes or courses. The background motivations of LIS schools in adopting KM education was their response to the natural evolution of the information field, the expansion of the LIS domain, and their response to the demands of graduates with KM skills, and ensuring academic competition.

KM course content and curriculum areas

One of the earlier frameworks of the content of real KM courses as suggested by Reardon (1998) consists of nine major areas of study including

<table>
<thead>
<tr>
<th>Curriculum Areas</th>
<th>Topics</th>
</tr>
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<tbody>
<tr>
<td><strong>1. Foundations</strong></td>
<td>Definitions and complexity of knowledge; Forms of knowledge (tacit, explicit); Sources of knowledge; Knowledge workers; Intellectual capital; Knowledge-based organizations; KM process; KM enablers; Knowledge sharing models.</td>
</tr>
<tr>
<td><strong>2. Technology</strong></td>
<td>Overview of commonly used technologies; Selection and design considerations for KM enabling technologies; KM architecture; KM tools and applications; Collaboration; Business Intelligence; Document Management Systems; Intranets/Portals/ Websites.</td>
</tr>
<tr>
<td><strong>3. Process (Codification)</strong></td>
<td>Knowledge audit; Capturing and acquisition of knowledge; Knowledge mapping; Organization and categorization of knowledge resources; Developing and maintaining knowledge repositories; Search and retrieval, use, and re-use of knowledge</td>
</tr>
<tr>
<td><strong>4. Applications</strong></td>
<td>Case studies and success stories of KM application in consulting firms and IT companies; Considerations for KM applications in different sectors and industries; Implementing a KM project in an organization.</td>
</tr>
<tr>
<td><strong>5. Strategies</strong></td>
<td>Integrating knowledge into organizational work to gain leverage from organizational knowledge resources; Steps for sustaining the KM work; Institutionalization of KM activities; Human resources and support (role and responsibilities of knowledge professionals); Measurement of knowledge assets.</td>
</tr>
</tbody>
</table>

*Source* Adapted from Chaudhry and Higgins (2001)
IT, electronic resources, communications technology, management, information management, research skills, transferable skills, knowledge studies, and behavioural studies. Chaudhry and Higgins (2003, 2001) categorized the frequently listed KM topics into five main curriculum areas as shown in Table 3.

Chaudhry and Higgins (2003, 2001) also showed the differences in perspectives and emphasis in the course contents and curriculum areas varying from more technology-oriented courses in computing schools to management oriented in LIS and business schools. These authors Brogan, Hingston, and Wilson (2001) have found strong support for knowledge computing, knowledge management foundations, and knowledge management practices as a KM course content. The categories of KM subjects featured in KM Masters courses offered by Australian universities include organization and management, technological applications, information organization and retrieval, business (especially e-business), and sociology of knowledge and learning (Ferguson and Hider 2006). The content analysis of available courses of LIS-based KM Master’s programmes shows that KM curricula consist of the following six clusters: KM Foundation, Information/Content Management, Information Systems/Computing Information Technology (IT), Business and Management, Human and Organizational Behaviour, and Miscellaneous (Roknuzzaman and Umemoto 2010). This content analysis further indicates that LIS schools concentrate more on IT and information than on business and human perspectives of KM.

Incorporation of KM into Digital Library Learning: a case analysis

In 2007, the International Master in Digital Library Learning (DILL) – a two-year Master Programme for information professionals who intend to work in the complex world of digital libraries – was developed in cooperation between Oslo University College (Norway), Tallinn University (Estonia), and Parma University (Italy). The first semester of DILL is offered at the campus of Oslo University College in Oslo, Norway. The second semester will be offered at Tallinn University in Tallinn, Estonia. The third semester will be offered at Parma University in Parma, Italy. The fourth semester involves writing a Master’s thesis. Table 4 summarizes the structure of DILL program, which includes six modules.

The pedagogical approach

The module of ‘Information and Knowledge Management’ (IKM) in DILL programme

<table>
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<tr>
<th>Table 4 Structure of DILL programme</th>
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<tbody>
<tr>
<td><strong>Semester</strong></td>
</tr>
</tbody>
</table>
| First Semester | Research Methods and Theory of Science (15 ECTS)  
| | Digital Documents (15 ECTS)  
| Second Semester | Information and Knowledge Management (15 ECTS)  
| | Human Resource Management (15 ECTS)  
| Third Semester | Access to Digital Libraries (15 ECTS)  
| | Users and Usage of Digital Libraries (15 ECTS)  
| Fourth Semester | Writing the Master’s thesis  

Source: DILL programme’s homepage
integrates both IM and KM, and it follows a social constructivist approach to learning. It means that a student, as a learner, is responsible for constructing his/her own meaning and interpretations. Knowledge cannot be transmitted to learners but must be constructed by learners through active engagement with others and the material world. Learning is a social activity (a collaborative experience) and the key to learning is for the learner to find multiple ways to link new information to previous experience. Teachers will no longer focus on the subject matter – creating and re-creating lessons, delivering repetitive lectures – but focus much more on coaching and tutoring activities.

**IKM course content in DILL**

The objectives of the IKM module are to provide students with indepth systematic knowledge and clear understanding of the nature and value, current practice and research on the information and knowledge management field; to make them understand IKM concepts, models, practices, technology, tools, and applications; to demonstrate a broad understanding of the changing role of information professionals in initiating and supporting the IKM initiatives in organizations; and to make them aware of the integration between IM and KM field. The module of IKM covers all major dimensions of KM; including the typology of information and knowledge, the identification of information/knowledge needs, and the acquisition, discovery, storage, organization, sharing, use and application of information/knowledge in the organizational context. One of the interviewees reported that they integrated the following dimensions or meta-categories into the IKM module:

- **Contents** - contain aspects of information resources management.
- **Context** - includes aspects of organizational and environmental issues affecting organizational information behaviour.
- **Process** - includes activities connected to information management (seeking, retrieval, scanning, and service).
- **People** - contain co-operational aspects, networks, individual level.
- **Technology** - includes technological aspects, systems, and databases

Thus, the IKM module incorporates a combination of skills and competencies related to information management, IT, business, human and organization skills, interpersonal and communication skills, personal behavioural skills, transferable skills, cognitive/intellectual skills, and intercultural competencies.

**Table 5** A modular approach to KM education in DL learning

<table>
<thead>
<tr>
<th>SL</th>
<th>Modules</th>
<th>Topics</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Information</td>
<td>Fundamentals of information and knowledge management&lt;br&gt;Organization of information and knowledge in a digital environment</td>
</tr>
<tr>
<td>2</td>
<td>Technology</td>
<td>KM tools and technologies&lt;br&gt;KM systems for DL</td>
</tr>
<tr>
<td>3</td>
<td>Business</td>
<td>Business/competitive intelligence&lt;br&gt;E-publishing, e-commerce, and KM</td>
</tr>
<tr>
<td>4</td>
<td>Human</td>
<td>Organizational learning and human capital management&lt;br&gt;Management of innovative knowledge services for DL users</td>
</tr>
</tbody>
</table>
The Proposed Framework of KM Education for DL Learning

The case analysis shows that the 'International Master in Digital Library Learning' includes only a module of 'Information and Knowledge Management'. KM is a broad domain that includes content from a number of fields, including LIS, IT, business and management, and human resources, among others. We strongly believe that a holistic approach to KM education is the need to prepare DL professionals to work in the digital age, which would require multi-dimensional knowledge. Roknuzzaman and Umemoto (2009, 2010) explored four major perspectives of KM from the cluster analysis of KM Master’s programmes such as information, technology, business, and human perspectives. These perspectives of KM can also constitute the modules of KM education in the field of DL learning. In addition, the case analysis and the review of literature suggest what the important contents of KM education are. Thus, we propose four modules of KM and eight relevant topics for KM specialization in the Master’s of DL, as mentioned in Table 5.

Conclusion

As a sub-field of both computer science and library science, DL is technology-oriented and deals with articulated or explicit knowledge. KM, on the other hand, is business and human-centric and deals with both explicit and tacit knowledge. Although DL and KM are two different fields, they bear some significant overlapping in the areas of their objectives, contents, people, processes and technology (Roknuzzaman, Kanai and Umemoto 2009). Some of the aspects of KM, especially content management, knowledge discovery and data mining, and information architecture are being practiced in DL. However, DL professionals require a wide range of skills and competencies related to strategic management of information, IT management, business process management, and human capital management to work in knowledge-intensive organizations like a DL. The proposed modular approach to KM education is a preliminary framework, and certainly this would enhance the skills and competencies of DL professionals. We hope to develop a more comprehensive and empirically tested framework of KM education for DL learning in our future work.

References


