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What do the highly-rated and accredited LIS programmes inform us about education in digital libraries?

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ABSTRACT

This paper examines the course offerings in digital library (DL) education, guided by the following specific research question: "What do the Library and Information Science (LIS)-accredited programmes inform us about education in digital libraries?" The paper provides an analysis of DL education which is included in the curriculum of 13 accredited and highly-rated library schools. Findings indicate that a significant DL content is present in the curriculum; and the inclusion is categorised into (a) an independent or full digital library course, (b) an integrated digital library course with other LIS topics, and (c) courses with close relation to DL processes. The title "Digital Libraries" appears to be the most popular title in the USA LIS schools sampled, and range from theory and practice, to project-based courses. The four UK LIS schools sampled do not have an explicit focus on DL topics. The curriculum areas for DL education suggested by Spinks and Cool (1999) are taken into account in analysing the content of the DL courses offered by the library schools. The paper also provides insights into the current state of DL education in Malaysia, and reports the findings of a small-scale survey, which has informed the LIS programme on how the DL course should be conducted. Findings from this paper may assist DL educators to develop DL modules and courses, standing on a solid foundation as well as following a standard curriculum design model of analysis, design/development, and evaluation practised by the renowned LIS schools worldwide.

Keywords: Digital library education; Library and information science (LIS) education; ALA-accredited LIS programmes; CILIP-accredited LIS programmes; Digital librarianship

INTRODUCTION

Library and Information Science (LIS) has always been a field concerned with the education of future librarians and information professionals, and, like many professions, with the integration of research with practice in the field and in the classroom. For too long, LIS schools have responded to the impact of Information Technology (IT) in the workplace by adding to

the existing LIS curricula courses such as Systems Analysis and Design, Database Fundamentals, Web Technologies and Electronic Publishing. Since the impact of IT on this discipline will continue to increase, and due to the changing nature of librarianship resulting from the increasing amount of information available in digital format, preparing LIS students to work in the digital library environment has become an important agenda within LIS schools nowadays. Digital libraries (DLs) require digital librarians, as they are required to select, acquire, organize, make accessible, and preserve digital collections, as well as plan, implement and support digital services. Researchers (such as Choi and Rasmussen 2006; Tanner 2001) have described digital librarians' roles, and have suggested core competencies and skills needed to perform these roles. In addition to their traditional library skills and knowledge, today's professional librarians are faced with the challenge of acquiring advanced knowledge and skills to augment what they traditionally learned. As a consequence, educating digital librarians who are competent to work in the dynamic and complex digital environment has become a high priority. Unfortunately, there are presently very few opportunities for librarians to receive training in the new tasks and responsibilities that digital libraries demand. Yang et al. (2206) highlighted that there is a shortage of supply and a lack of digital librarians with the right combination of skills, and opined that there has not been much focus on education for people who design and administer DLs compared to the investment in DLs.

By the end of 2006, 28% (5/18) of all universities with accredited programmes by the Chartered Institute of Library and Information Professionals (CILIP) in the UK and over 60% (34/56) of all library schools accredited by the American Library Association (ALA) in the USA and Canada are offering specific DL education. This was analysed in Ma, O'Brien and Clegg (2008) based on the DL module titles and description shown on-line. Around 40% of DL education is now either specialized independent or certificate programmes and courses, mainly in North America. While most of the LIS schools offer courses related to digital information management and services such as "Digital Libraries" and "Digital Library Technologies", there are many different approaches and topics covered in this type of course. Many educators in DL education believe that 'defining digital librarianship is a complex area and the knowledge and skills needed to perform digital library jobs are difficult to acquire in the graduate library school curriculum (Saracevic and Dalbello 2000; Spink and Cool 1999). An important step in dealing with these needs is to design courses appropriate for preparing future digital librarians for the workplace. In order to do so, it is important to identify what and how the topics of DLs are being taught in LIS programmes.

The purpose of this study are to identify and examine current courses or programmes in DL education, and consider how best to educate and train digital librarians Specifically this paper highlights the trend in DL education in LIS programmes. The paper will first provide a review of research in DL education, followed by an attempt to identify the state of the art in DL education in LIS-accredited programmes. This investigation was guided by the following specific research question: "What do the LIS-accredited programmes inform us about education in digital libraries?" The paper also provides insights into the current state of DL education in Malaysia, and reports the findings of a small-scale survey, which has informed the LIS programme at a Malaysian university on how the DL course should be conducted. Findings from this paper may assist DL educators to develop DL modules and courses, standing on a solid foundation as well as following a standard curriculum design model of analysis, design/development, and evaluation practised by the renowned LIS schools worldwide.

PREVIOUS WORK

There has been a steady stream of studies of LIS curricula over the years. In reviewing previous studies of LIS curricula or syllabi, Pomerantz et al. (2006) pointed that most of these studies were concerned with the topics addressed in LIS courses on various subjects, such as bibliographic instruction, business information, information technology, the economics of information, and popular culture. A few existing studies of LIS curricula or syllabi, have been concerned with courses on DLs. Report findings from the first international survey of DL courses and curriculum by Spink and Cool (1999) suggested that Computer Science (CS) and LIS faculty seem to have the strongest hold on what is taught for educating digital librarians. Two methods were employed: (a) analysis of the websites of CS and LIS schools to determine if courses listed dealt with digital libraries and (b) e-mail survey CS and LIS faculty to respond with an indication as to whether they offered courses on digital libraries. The study revealed that the subject of digital libraries has been receiving attention on an international level since 1999 from 20 institutions, including one university in Malaysia offering this course at the postgraduate level. Most of the courses identified in Spink and Cool's study were technical in orientation and focused on system and digital collection building; less frequent attention is being given to the study of digital library users and usability.

In a second survey, Saracevic and Dalbello (2001), employing method similar to Spink and Cool, found a significant increase in the number of digital library courses offered at ALA accredited programmes. Nearly 90% (47) of the ALA accredited programmes in 2001 had courses that dealt with DLs, but only 15 of these were specifically dedicated to DLs. The rest included digital libraries as a unit in a course. Saracevic and Dalbello took their analysis further and looked at the course content of the 47 courses. They identified the following elements as part of the course content: knowledge management, standards, document structure and electronic text, preservation, community building and social context.

Liu (2003) conducted the third survey using website analysis method and she examined LIS programmes around the world. She found 36 websites with DL courses. This compares with 20 such websites found in 1999. 20 out of the 36 schools identified offered DL courses and were ALA accredited programmes, twice the number found in the Spink and Cool's 1999 survey. The remainder of the programmes were CS or LIS programmes in Europe, South America or Asia. Liu found that among those LIS programmes, the course content tended to be technical in nature outside North America, while in North America the content focused on topics such as organizing, preserving, managing and providing access to collections.

A review of progress in DL education and recent studies (Ma, Clegg and O'Brien 2006; Ahmad Bakeri 2009) pointed out that the number of library schools offering DL education is still growing. Ma, Clegg and O'Brien (2006) examined the current status of DL education and compared the range of provision with that found in the three earlier studies. It is found that the number of institutions offering programmes or courses in DL education is still increasing. About 43% of these programmes or courses are stand–alone rather than integrated with wider material. They opined that the curriculum design and focused teaching areas appear more systematic and comprehensive than in earlier studies. Over half the institutions examined in this study posted their detailed course information on-line, and most courses offered are

based on a combination of theory and practice, and are available at different levels. In order to understand the extent of incorporation of the digital components in the curricula of the LIS schools in the Asian region, Ahmad Bakeri (2009) examined postgraduate programme in LIS as well as the digital library courses offered by 51 institutions. Only eight out of the 20 countries surveyed are offering independent digital library courses in their LIS programmes, namely India, Indonesia, China, South Korea, Malaysia, Hong Kong, Taiwan, and Thailand. The study reveals that the numbers of academic institutions that are offering digital library education in Asia are few as compared to their number globally. The paper concludes that countries which have reached a certain economic level are inspired to offering digital library education, and this seems to indicate a relationship between the level of ICT development in a country with the willingness to offer digital library education.

Yang et al (2006) reported on the University of North Carolina's at Chapel Hill (UNC-CH) effort and progress in developing DL curriculum and materials appropriate for the CS and LIS communities. The modules were designed, based on input from the project advisory board, Computing Curriculum 2001, the 5S framework (Conclaves 2004), and workshop discussions. The modules were evaluated, first through expert inspection and, second, through field testing. The developed curriculum should contribute to producing well-balanced digital librarians who will graduate from CS or LIS programmes. Bawden, Vilar, and Zabukovec (2005) compared the digital library education and training programmes in two countries, the UK and Slovenia. Their findings showed that the digital library conceptual, semantic, syntactic and technical aspects are being included in existing courses. While there is some agreement on core topics, there is much variation in how they are presented, and in the relative importance given to them.

Choi and Rasmussen (2006) surveyed 48 DL professionals in academic libraries in the USA to learn more about the nature of digital library work practices and to identify common and necessary attributes required of digital librarians. Their findings suggested that professional education programmes for digital librarians should provide not only technical skills and traditional library training, but also should place greater emphasis on project management skills through practical experience of a digital project. The respondents in the study were invited to provide their suggestions for LIS educators or schools on areas that should be added to the DL curriculum. Topics suggested include digital library design, digital preservation, digitization, and current digital technologies such as OAI-PMH, metadata standards, XML, EAD, and TEI. Based on this survey, it appears that LIS education needs to integrate practical skills and experience with digital collection management and digital technologies into the curricula. Tammaro (2007) on the other hand, analysed the trends for digital library education in Europe to identify the roles for digital librarians and how they should be educated. She wrote that education for digital librarians in Europe is affected by the main trends in relevant research for digital libraries, which are moving from the stage of isolation of IT from LIS schools, to a transition with a purely technological approach, towards a better appreciation of social and human aspects in studies of cultural heritage. A structure of a course for digital library education is proposed and the suggested educational model is based on a multi-layered concept of communication of memory that reflects the complex nature of cultural heritage phenomenon in Europe and foresees the synergies between LIS, archival science, museology and computer science.

METHOD

The method for this study was derived from those used by Spink and Cool (1998), Saracevic and Dalbello (2001), Liu (2003) and Ma, Clegg and O'Brien (2006). In an effort to answer the research question, this paper looks at the current state of DL education by looking at only LIS-accredited programmes offering courses on this topic. Only highly-rated library schools (rated < 80% in the UK and <4.0 in the USA) with ALA (American Library Association) and CILIP (the Chartered Institute of Library and Information Professionals) accredited programmes in the USA and UK respectively were considered for analysis. Other accredited LIS programmes offering DL focused-courses from the rest of the world were included: they are (a) Victoria University of Wellington, the only provider of post-graduate library qualifications in New Zealand and accredited (by the Library and Information Association New Zealand Aotearoa (LIANZA)); (b) Charles Sturt University in Australia, the only LIS school accredited by the Australian Library and Information Association (ALIA); and (c) three LIS schools in Canada accredited by ALA. Institutions offering DL programmes (such as the Digital Library Summer Course at Tilburg University, Netherlands and Syracuse University, USA) and DL courses offered by computer science and other disciplines were excluded. This is useful information for identifying the scope of what is taught on DL in LIS, however it does not provide more specific information such as which topics should be given more or less emphasize.

An on-line data collection of LIS programmes was carried out during the period from June to August 2009. Syllabi of DL courses at the graduate level were collected, in which the phrase "Digital Library", "Digital Libraries" or "Digital librarianship" were used in either the course title or the course description. Courses that mention processes that are closely related to DLs, such as "management and preservation of electronic records, electronic text design, metadata for digital collections, production of network multimedia, designing accessible web based materials, and electronic text" were also included. Courses that integrate DL content into other courses, or offer courses that do not have digital libraries in their title but focus on the creation of distributed electronic repositories of information or digitisation of resources, are also taken into consideration. Tables 1, 2 and 3 present 13 universities in total offering DL courses by their accredited library schools. The phrases "Digital Library", "Digital Libraries" or "Digital librarianship" which appears in the course description in these three tables are italicized and highlighted. All URLS are valid when revisited on 30 September 2009.

Table 1: Universities in UK* with CILIP accredited programmes offering DL courses

Rating (Score)	Institution / (Programme)	Course Title Course Description
1 (100)	Loughborough University, Deparment of Information Science (MSc Information and Library Management)	**Digital Curation** Digital curation in different contexts. Characteristics of digital media and digital resources and their implications for longevity. Digital preservation strategies. Risk assessment and lifecycle management of digital resources. Digital archiving and archives. Role of registries. Legal issues. Cost issues. National and international digital curation initiatives. The role of metadata. Course description at: http://cisinfo.lboro.ac.uk/epublic/wp5015.module_ spec?select_mod=09ISP428
2 (93.9)	The University of Sheffield, Department of Information Studies (MA in Librarianship)	**Information Retrieval: Search Engines and Digital Libraries** Web search engines and ***digital libraries*** have become the most prominent examples of searching services, however, many others exist, such as library cataloguing systems and proprietary search engines. Understanding the workings of such services can enable information seekers to search more effectively. The module will describe the wide range of techniques employed in commonly used searching resources: keyword searching, subject analysis, metadata, hypertext, and the means users employ to search for information. One focus of the module is on Web search: discussing how search engines work, what problems they encounter; alternative forms of Internet search (eg P2P); and how Web pages can be optimised for search engines. Course description at: https://www.online.shef.ac.uk/pls/live/web_cal.cal_unit_detail?unit_code=I NF206&ctype=AUT+SEM&start_date= 25-SEP-06&mand=Optional
3 (88.8)	University College London (UCL), Department of Information Studies (MA in Library and Information Studies	**Encoded Archival Description and Digitisation of Archives** This module provides students with knowledge and understanding of Encoded Archival Description (EAD) and explores the encoding of digital finding aids. It introduces students to Extensible Mark-up Language (XML) and to the nature and use of document type definitions (DTDs) and schemas. It examines the background and development of EAD, its relationship to the principles of archival arrangement and to other methods of archival description, and its practical application to the descriptive work of archivists. It also considers other approaches to digitisation including the imaging of archival materials and the use of digitised transcripts. A substantial proportion of this module involves practical work. Students critically assess a range of current projects in the archive domain and gain practical experience of creating archival finding aids using EAD. Course description at: http://www.ucl.ac.uk/infostudies/teaching/ modules/instg041/
4 (85.4)	Aberystwyth University, Department of Information Studies (MSc Econ Information and Library Studies)	**Digital Information: Discovery to Delivery** Following government funding in various countries worldwide collections of digital information, or ***digital libraries***, emerged during the 1990s as a key development area in practice, as well as in research, for information professionals, computer scientists, librarians, archivists as well as those involved in cultural heritage institutions. The advantages of such collections for users are various as they provide access to digital information sources on a 24/7 basis and are important in supporting changing patterns of teaching and learning in educational establishments, for general lifelong learning programmes, for global access to cultural artefacts, government information and so on. In addition they are seen by many as an opportunity to overcome the `digital divide? between countries as information can be made available in a language and format appropriate for users. Students of this module will explore and critically assess ways in which digital information is created, acquired, organised and presented within digital libraries so as to support its discovery and delivery. Examples of ***digital libraries*** implemented in many countries will be studied and in particular the digital collections made available from the National Library of Wales will be used as a case study. Course description at: http://www.aber.ac.uk/en/ modules/deptcurrent/?m=ILM7510

*Top institution in the UK to study LIS courses rated by Times Good University Guide June 2009

Table 2: Universities in USA* with ALA accredited programmes offering DL courses

Rating (Score)	Institution / (Programme)	Course Title Course Description
1 (4.5)	University of Illinois--Urbana-Champaign (UIUC), The Graduate School of Library and Information Science (MSc Information and Library Management)	**Digital Libraries: Research and Practice** A comprehensive examination of the history and state-of-the-art in ***digital library*** research and practice. Focuses upon the theoretical, technological, human factors and evaluative components of ***digital library*** research and practice. Course includes an intensive reading of the literature, review of existing technologies and proof-of-concepts implementation projects. This course This course is foundational for students wishing to engage seriously in the world of ***digital librarianship***. Students should have access to a personal computer upon which they can experiment on their own with downloaded software tools. Students must be competent in basic computing including the installation and configuration of software packages. Course description at: http://www.lis.illinois.edu/oc/courses/course-detail.html?id= LIS590DI&year= 2009&semester=FA
1 (4.5)	University of North Carolina-Chapel Hill (UNC-CH), School of Information & Library Science (MSc in Library Science)	**Digital Libraries: Principles and Applications** Research and development issues in ***digital libraries***, including collection development and digitization; mixed mode holdings; access strategies and interfaces; metadata and interoperability; economic and social policies; and management and evaluation. Course description at: www.ils.unc.edu/courses/2008_spring/inls740_001/740syllabus.pdf **Digital Preservation and Access** Focuses on best practices for the creation, provision, and long-term preservation of digital entities. Topics include digitization technologies; standards and quality control: digital asset management; grant writing; and metadata. Course description at: http://ils.unc.edu/ ~hcarolyn/inls752_syllabus_fall2009.pdf
3 (4.4)	Syracuse University, School of Information Studies (MSc in Library and Information Science)	**Digital Libraries** Representation of information in ***digital libraries***; mechanisms for retrieval; digital intermediation; sociopolitical environment for ***digital libraries***. Course description at: www.slais.ubc.ca/COURSES/wise/fall05/Syracuse-digital-libraries.pdf
5 (4.1)	University of Michigan Ann Arbor (UMich), School of Information (MSc Library and Information Services)	**Digital Libraries and Archives** This course focuses on the current state of "***digital libraries***" from a multidisciplinary perspective. Its point of departure is the possibilities and prospects for convergence of professions and cultures around the notion of digital media and content. The course covers the history of the idea of the ***digital library*** and the digital archive, especially its manifestation as projects and programmes in academic, nonprofit, and research settings, and the suite of policy issues that influence the development and growth of ***digital libraries*** and archives. A foundation of core archival principles as applied in ***digital library*** and archives settings serves as an intellectual construct supporting the exploration of the related concepts of scholarly communication, digital preservation, cyberinfrastructure, representation, and standards/best practices. Students are expected to master a diverse literature, to participate actively in the discussion of issues, and to take steps, collectively and individually, to advance our understanding of future directions of digital libraries and archives. Course description at: http://www.si.umich.edu/courses/ description.htm?passCID=552
6 (4.0)	Rutgers, The State University of New Jersey New Brunswick, School of Communication and Information, Library and Information Science Department (Master of Library and Information Science)	**Digital Libraries** Fundamental issues, problems, and approaches to ***digital libraries***, reflecting differing efforts and thinking in a number of fields and enterprises. Variety of ***digital library*** collections; organization, access, and use of ***digital libraries***. Technical infrastructure; socioeconomic issues; integration of information resources; relation to traditional libraries. Current projects and initiatives. Course description at: http://comminfo.rutgers.edu/component/option,com_courses/task,view/sch,17/cur,610/num, 553/Itemid,54/

*Top institution in the USA to study LIS courses rated by the US News & World Report 2010
Rated 4 (Score 4.3), University of Washington Seattle's MLIS programme does not offer a course on digital libraries.

Table 3: Other universities* with professionally accredited programmes offering DL courses

Country (Accreditation Body)	Institution / (Programme)	Course Title Course Description
Australia (ALIA)	Charles Sturt University (CSU), School of Information studies (Master of Information Studies)	**Digitisation** Digital content forms the building blocks of the online cultural economy and is therefore significant in creating identity within this networked environment. This subject introduces processes of digital content creation and management within an open networked environment. The role that open content-sharing platforms can play in promoting digital collections and generating social capital will be covered, alongside the impact that these platforms have for the work of information professionals. Course description at: http://www.csu.edu.au/handbook/handbook10/subjects/INF517.html
New Zealand (LIANZA)	Victoria University of Wellington, School of Information Management (Master of Library & Information Studies)	**Digital Libraries** An introduction to the creation and maintenance of ***digital libraries*** that addresses terminology, purpose and methods Covers digitisation of information and its organisation and preservation. Course description at: http://www.sim.vuw.ac.nz/degrees/mlis/547-details.aspx
Canada (ALA)	University of Toronto	**The Future of the Book** This course considers the history and possible futures of books in a digital world. In this course "the book" is interpreted broadly, meaning not just an object with covers and pages, but also an evolving metaphor for conceptual frameworks for knowledge, and a metonym that brings together many different technologies, institutions, and cultural practices. The course introduces students to interdisciplinary approaches such as book history, textual studies, history of reading, and digital humanities, with an emphasis on balancing theoretical speculation with practical implementation. Readings will survey topics such as the ontology of born-digital artifacts, critical assessment of digitization projects, collaborative knowledge work, reading devices (old and new), e-book interface design, text/image/multimedia relationships, theories and practices of markup, the gendering of technologies, the politics of digital archiving, the materiality of texts, and the epistemology of digital tools. Students will also receive a practical introduction to XML markup and visualization tools. Course description at: http://www.ischool. utoronto.ca/programs-courses/course-list
Canada (ALA)	University of Alberta School of Library and Information Studies (Master of Library and Information Studies)	**Digital Libraries** An introduction to the concept, development, types and trends of ***digital libraries***. This course will focus on the creation, organization, access, use and evaluation of ***digital libraries*** with a view to socio-economic and cultural issues. Course description at: http://www.slis. ualberta.ca/538outline.cfm

*Accredited by ALA and highly rated in Canada by Gourman Report Ranking of Canadian Universities.
McGill University's MLIS programme does not offer a course on digital libraries

WHAT TO TEACH ABOUT DIGITAL LIBRARIES? : AN ANALYSIS OF CONTENT

An analysis shows that DL education is included in the curriculum of accredited and highly-rated library schools. A significant DL content is present in the curriculum; however, the degree of inclusion varies widely. When considered closely, the inclusion is categorised into three types: (a) type 1 is independent or full digital library course (e.g. in most US library schools sampled), and (b) type 2 is a digital library course integrated with other topics (e.g. courses on digital libraries and archives [e.g. at UMich] and digital libraries and information retrieval [at

Sheffield and Aberystwyth]), and (c) type 3 refers to courses that cover processes that are closely related to DLs such as digital curation and digitisation of archives (e.g. Loughborough and UCL). Of the 13 DL courses that were identified, six (6) are in the type 1 category (UIUC, UNC-CH, Syracuse, Rutgers, Victoria and Alberta), three (3) are in type 2 (Sheffield, Aberystwyth and UMich) and four (4) in type 3 (Loughborough, UCL, Charles Sturt and Toronto). The phrases “Digital Library", "Digital Libraries" or “Digital librarianship” appears in 9 DL course description. The title “Digital Libraries" seems to be the most popular title for all ALA-accredited programmes sampled, as well as Victoria University of Wellington, and range from theoretical and practical, to project-focused courses. The four CILIP-accredited LIS schools sampled do not have an explicit focus on DL topics. The title "digital curation" and “digitisation of archives” are given primary emphasis in two UK library schools (Loughborough and UCL), as well as in Australia (Charles Sturt University). This seems to suggest that the DL education in UK and USA are focusing on different approaches to DL development and different applications and implementations of DLs in practice. This may be largely due to the convergence of archives, libraries and museums (ALM) which is the approach that characterises the evolution of digital libraries in Europe affirmed in Tammaro (2007). One clear finding from this study, which supports the findings of those reviewed earlier, is that there is no single description agreed upon what constitutes a DL course in LIS schools.

Spinks and Cool (1999) posit that digital libraries are first and foremost *libraries*, and, as such, any model curriculum should maintain a core set of courses that address the major functions and activities of libraries in general, in both digital and traditional forms. The curriculum areas for digital libraries education suggested by Spinks and Cool (1999) are taken into account in analysing the content of the DL courses offered by the LIS schools. Table 4 demonstrates content analysis of DL courses offered by 13 LIS schools in US, UK, Australia, New Zealand and Canada. Majority of the LIS schools offered independent or full DL course (type 1) depicted as “F” while other schools integrate DL content with other LIS topics (type 2) depicted as “I” or offer courses that are close relation to DL processes (type 3) depicted as “R”. Table 4 shows that most of the LIS programmes focus on two main topics – knowledge organization and collection development. Most independent or full DL course looks at the technical infrastructure and the functional uses of technology DL. The environment approach focuses on digital libraries in social and cultural environments, as related to the communities of practice (the emerging profession of digital librarianship) is also the focus of most independent DL course.

Table 4: An analysis of DL courses offered by the LIS schools sampled based on Spinks and Cool (1999)

CURRICULUM AREAS: (Topics)	Loughborough	Sheffield	UCL	Aberystwyth	UIUC	UNC-CH	Syracuse	UMich	Rutgers	CSU	Victoria	Toronto	Alberta
Inclusion of DL content*	R	I	R	I	F	F	F	I	F	R	F	R	F
THEORETICAL AND HISTORICAL FOUNDATIONS (History of libraries; Human information behavior; Information retrieval theory; Development of digital collections and digital libraries)	NA	NA	NA	NA	√	NA	NA	√	√	NA	√	NA	√
TECHNICAL INFRASTRUCTURE OF THE DIGITAL LIBRARY (Information retrieval engines; Database construction of digital libraries; Distributed collections; Multimedia formats and applications; Interoperability; Network technology; Web applications in digital libraries; Interface design; Communication protocols; Query languages)	NA	√	NA	NA	√	√	√	√	√	NA	NA	NA	NA
KNOWLEDGE ORGANIZATION IN DIGITAL LIBRARIES (Metadata; Indexing; Classification; Database integration; Document formats)	√	√	√	√	√	√	NA	√	√	NA	√	NA	√
COLLECTION DEVELOPMENT AND MAINTENANCE (Digital archives; Digital conversion technology; Digital preservation)	√	NA	√	√	√	√	√	√	√	NA	√	√	√
INFORMATION ACCESS AND UTILIZATION OF DIGITAL LIBRARIES (Users and uses of digital libraries; Usability and evaluation research; Information behavior in digital libraries)	NA	NA	NA	NA	NA	√	NA	√	√	NA	NA	√	√
SOCIAL, ECONOMIC AND POLICY ISSUES (Electronic publishing; Scholarly communication; Copyright issues and intellectual property rights in digital libraries; Costs of building digital libraries; Funding for digital libraries)	√	NA	NA	NA	NA	√	√	√	√	NA	NA	√	√
PROFESSIONAL ISSUES (Roles and responsibilities of the digital librarian; Management of digital libraries; Bibliographic instruction)	NA	NA	NA	NA	√	NA	NA	√	NA	NA	NA	NA	NA

* F- Independent / full DL Course; I – Integrated with other LIS topics; R – Courses with close relation to DL processes
NA – Not available from the course description indicated in Table 1, 2 and 3

DL EDUCATION IN MALAYSIAN LIBRARY SCHOOLS

There are three library schools in Malaysia, and at present two of them are offering postgraduate courses on DLs (Table 5). The Department of Library and Information Science, International Islamic University Malaysia (IIUM), although was included in Ahmad Bakeri's (2009) study, does not list a course on digital libraries in the current study plan (Available at http://kict.iiu.edu.my/?q=node/61; updated 22 Nov 2009), and a detailed DL course syllabus or description is also not provided on-line. The University of Malaya (UM) has been offering a stand-alone course on digital libraries since 1998, whereas the MARA University of Technology (UiTM) has an integrated DL course that combines the concept of digital, virtual libraries and applications of multimedia systems. Based on the current course description, both courses require students to work on a digital project; UM prepares students to "develop, evaluate, or apply digital library technologies in their work environment; where they will construct a small scale digital library using specialized software tools such as DSpace and Greenstone" (See http://adec.um.edu.my/code). UiTM on the other hand requires students to "plan a multimedia project, design and develop a multimedia product relevant to current needs in the library environment". Both are elective courses with three (3) credits.

Table 5: Malaysian universities with LIS programmes offering DL courses

No	Institution / (Programme)	Course Title Course Description
1	University of Malaya, Faculty of Computer Science and Information Technology, Library and Information Science Unit (Masters of Library and Information Science)	**Digital Libraries** ***Digital Libraries*** (DLs) are increasingly popular research area that encompasses more than traditional information retrieval or database methods and techniques. The class will focus heavily on project work i.e. DL development. Students will work together in teams to create fully functioning ***digital libraries***. They will work together to appraise, select, digitize, describe and make available the materials. Case studies will be performed on various DLs. Topics to be covered include: (a) ***Digital library*** concepts; ***Digital libraries*** and the global Information society; Development of digital collections and ***digital libraries***; (b) ***Digital library*** initiatives and research projects; models and framework; (c) Technical infrastructure of the ***digital library***: Information retrieval engines; Database construction of ***digital libraries***; Distributed collections; Multimedia formats and applications; Interoperability; Network technology; Web applications in ***digital libraries***; Interface design; Communication protocols; Query languages; (d) Knowledge organization in ***digital libraries***: Metadata; Indexing; classification; Database integration; Document formats; (e) Collection development and maintenance: Digital archives; Digital conversion technology; Digital preservation; (f) Information access and utilization of ***digital libraries***: Users and uses of ***digital libraries***; Usability and evaluation research; Information behavior in ***digital libraries*** (g) Social, economic and policy Issues: Electronic publishing; Scholarly communication; Copyright issues and intellectual property rights in digital libraries; Costs of building ***digital libraries***; Funding for ***digital libraries*** (h) Professional Issues: Roles and responsibilities of the digital librarian; Management of ***digital libraries***; Bibliographic instruction. Course description available at: http://www.fsktm.um.edu.my/web/bukuPanduan/admin/it/data/ 2009-2010-Master%20of%20Library%20and%20Information%20 Science.pdf
2	MARA University of Technology, Faculty of Information Management (MSc Library Science)	**Digital Libraries and Multimedia Applications** This course examines the concepts of digital and virtual libraries and applications of multimedia systems. It includes developing competencies, skills and knowledge in ***digital library*** management. Students are required to plan a multimedia project; design and develop a multimedia product relevant to current needs in the library environment. Course description available at: http://fim.uitm.edu.my/index.php?option=com_content& view=article&id=75 is772&catid=64:postgraduate&Itemid=64

Comparison of the two DL course descriptions in Table 5 seems to indicate that UM offers by far a developed programme of study for digital librarianship. It combines practical and skill-based programme with a focus on digital library development project where the students will "work together in teams to create fully functioning digital libraries.....to appraise, select, digitize, describe and make available the materials". Internationalisation of the curriculum for DL has been a strategy followed by the programme as it covers and exactly follows six out of the seven curriculum areas suggested by Spinks and Cool (1999) when mapped with the course description. The first curriculum area (theoretical and historical foundation) by Spinks and Cool was replaced with the following two topics in UM's DL course: (a) Digital library concepts; and (b) Digital library initiatives and research projects.

An important component of teaching is "theory to practice curriculum" related to research and development, since the MLIS programme at UM has an excellent environment for implementing DL idea and research oriented DL projects. The Digital Library Research Group (DLRG), positioned under the Library and Information Science Unit, Faculty of Computer Science & Information Technology (FCSIT), University of Malaya (http://www.fsktm.um.edu.my), is committed to research and provision of information infrastructure for digital resources to be properly organized, archived and disseminated. Some of its ongoing research projects are the Malaysian Abstracting and Indexing System (MyAIS) (http://myais.fsktm.um.edu.my), the Digital Library of Malay Manuscripts (MyManuskrip) (http://mymanuskrip.fsktm.um.edu.my) and the university's Institutional Repository (UMDSpace) (http://dspace.fsktm. um.edu.my). The impetus for a growth of activities associated with DLs by the LIS Unit may come from two sides: the opportunities for the DLRG to partner with their systems and network colleagues to research on DL social and technical trends and associated problems, and more importantly, availability of substantial research funding to address the problems. As such, the programme at UM has the means to explore how best to teach with DLs and conduct research on the best ways to teach about DLs. A small scale DL course survey was conducted. The finding, which has informed the programme on how the DL course should be conducted, is presented in the following sub-section.

The DL Course Survey

To identify areas of particular strength and weakness in DL education prior to the current DL curriculum, a survey was conducted during the 2nd Semester of the academic session 2008/2009 on 45 registered Masters of Library & Information Science (MLIS) students. Thirty-three of the questionnaires were answered and returned which made a 75% response rate. The demographic information of respondents shows that 67% (22) of them are female and the remaining 33% (11) are male. At about 49% (16) of the respondents are between 25 to 30 years old, and 33% (11) of them are between the age of 31 to 35 years old and the remaining 18% (6) are under 25 years old. This shows that the MLIS students in FCSIT UM are mainly matured students with the age between 25 to 35 years old.

Given the definition of digital library as "a managed collection of information, with associated services, where the information is stored in digital formats and accessible over a network (Arms 2000)", the findings indicated that all respondents were familiar (100% Yes response) with the term 'digital library' as defined in the survey questionnaire. Defining the term "digital

library" at the beginning of the survey is seen as important to ensure that respondents have the same understanding of what digital library is.

The survey is divided into two sections. The first section was targeted at respondents who have taken DL course (30%, (10); category 1), whereas the second section was for respondents who have not taken the course (70%, (23); category 2). Since the course is an elective and is only offered once in an academic session, the percentage of respondents who have taken the course is rather low.

Figure 1 illustrates the percentage of responses regarding the relevance of the course materials. Analysis of data for this is based on the 30% (n=10) of respondents in the first category. Based on the figure, those who have already taken DL course agreed that the current course materials are relevant. Besides, they also felt that the materials are understandable.

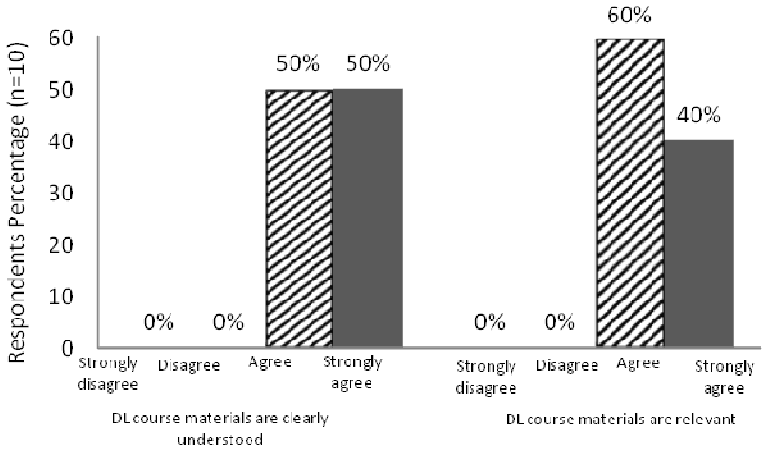

Figure 1: Responses regarding the teaching materials of the DL course

Figure 2 depicts some major problems faced by students (n=10) when they are studying for the course. Seven (7) respondents stated that the "lack of coursework resources (such as DL software, application and tools)" as the major problem when they are studying for the course. Besides that three (3) respondents indicated "lack of reference materials" such as textbooks, reference books and journals. Hence this finding highlighted that DL software, application and tools are important to help students in studying for the DL course.

A total of eight (8) students who belong in the first category reported that they do not have the practical experience on the use of DL software, application and tools during or after they have taken the course. Both categories of students were also asked on their opinion whether the DL course should be theoretical knowledge-based or provide more practical experience.

More than one third of the respondents disagree (61%, 20) and that the course should emphasize more on theoretical knowledge. The same percentages of respondents (61%, 20) agree that digital library course should emphasize more on practical work. This suggests that the majority of the students felt that they (a) lack practical experience on how to use and manage digital library; and (b) are more interested to have hands-on work in using DLs in the course. Figure 3 presents the findings.

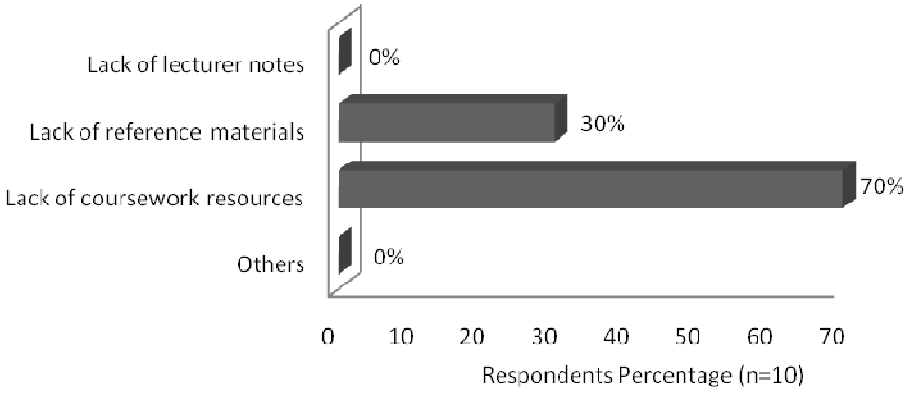

Figure 2: Problems faced by students while studying for the DL course

The survey has discovered that students face difficulties when they are studying DL course as well as highlighted how DL course should be conducted either based on theoretical or practical work. They demand practical experience in using DLs. The survey also demonstrated that most of the respondents agreed that DL course should include more practical work or hand-on which is in agreement with Liu (2004) and Saracevic and Dalbello (2001). The use of the DL software, application and tool could increase understanding, knowledge and provide hands-on experiences to students in learning DL course in which they will have the experience in collection development, management and knowledge dissemination.

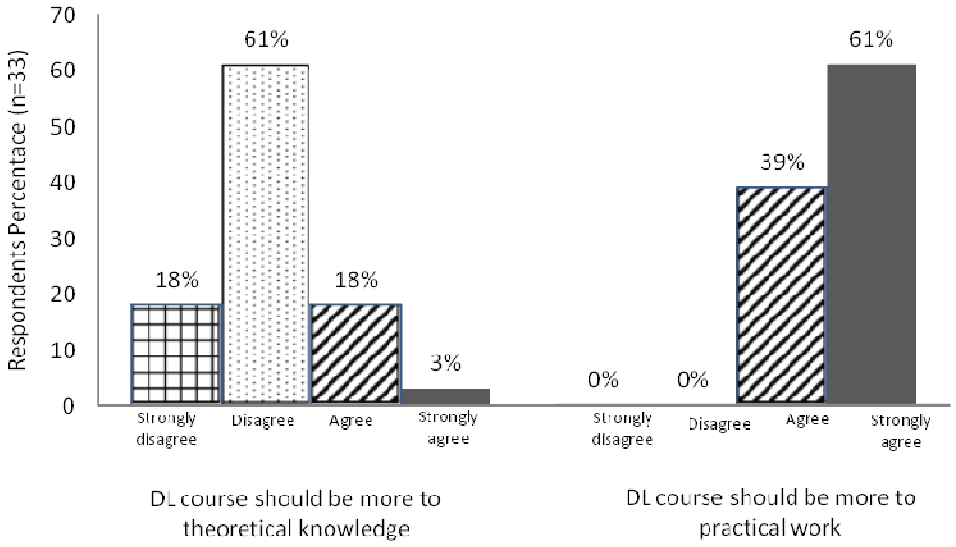

Figure 3: Responses on how DL course should be conducted.

CONCLUSION

The paper has provided an analysis of DL education which is included in the curriculum of 13 accredited and highly-rated library schools, as well as insights into the current state of DL education in Malaysia. It has also reported on the findings of a small-scale survey at one Malaysian university offering LIS programme with DL course, which has informed the programme on how the DL course should be conducted. The study indicates that DL education is visibly present in the curriculum of accredited and highly-rated library schools, and the inclusion is categorised into three types: (a) an independent or full digital library course, (b) an integrated digital library course with other LIS topics, and (c) courses with close relation to DL processes. The curriculum design and focused teaching areas appear systematic and comprehensive, based on a combination of theory and practice. Although a standard and optimized model of best practice in DL education has not yet emerged, but there is progress in this area. In LIS programmes, the current educational approach for digital library education places it within information technology context. The topics suggested for the courses emphasized a balance between theory and practical skills. These ranged from courses relevant to working in the real world of DLs – with respect to technology and standards, funding, copyright issues, programming, user studies and scholarly communication – to courses on the theory of digital libraries, to help in understanding the big picture for various digital library applications. Integration of DL education in the context of foundations, knowledge representation, and archives is not surprising either. It is driven by the concerns of research and practice communities. The library schools with least developed programmes of digital

library education (as indicated by curriculum areas by Spink and Cool 1999) typically contain this education within information technology or foundations context.

This work and other studies reviewed here show there is a need for LIS educators to explore the specific question of what should be the standard framework for DL education in LIS to ensure that students and their employers, can be assured of having an adequate skill set to work confidently and productively in this area. This was also pointed out by participants in the Joint Conference of Digital Libraries 2005 (Ma, Clegg and O'Brien 2006) that library educators need to work with researchers and practitioners in digital libraries to help develop a well-rounded curriculum, as DL work is collaborative and that consequently education for this field should be as well. Cross-disciplinary and cross-institutional collaboration on DL curriculum developments has emerged in the Malaysian scene and educators in the DL area should be working increasingly closely with researchers and practitioners in digital library developments. Findings from this paper may assist DL educators to develop DL modules and courses, standing on a solid foundation as well as following a standard curriculum design model of analysis, design/development, and evaluation practised by the renowned LIS schools worldwide.

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