Infusing Digital Curation Competencies into the SLIS Curriculum

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Abstract— **The unprecedented rate of growth of digital information requires professionals with digital curation skills and knowledge. However, education and training programs are inadequate to meet the demand. An infusion of digital curation competencies into the Library and Information Science curriculum is required to ensure that today's digital assets are available today and tomorrow. The purpose of this paper is to describe the ways in which Digital Curation Competencies are integrated into the MLIS curriculum at San José State University. Course descriptions are provided for several MLIS courses, and a crosswalk is presented demonstrating the correlation between the MLIS core competencies supported by those courses and the operational and professional core competencies identified as necessary for Digital Curators. One course, *Professional Experiences: Internship*, is offered as an effective way for students to apply their digital curation skills and knowledge in the real world, either by working on site or working remotely.**

Keywords—Digital curation, core competencies, curriculum, internship

I. INTRODUCTION

"From the days of the early cave dwellers who painted symbols onto stone walls through today when social media–savvy citizens post their own digital messages on Facebook walls, three factors remain constant: human beings are compelled to record their experiences, using the tools and technologies available to them, with the intent to share that information with others" [1] today and in the future.

The act of creating and disseminating information was an enormous challenge to early record keepers, and the privilege and responsibility for doing so was placed in the hands of a select few. Whether chiseled in stone or written on parchment, these records allow us to learn more about the history and culture of ancient civilizations.

The task of preservation was taken seriously, as evidenced by the estimated 20,000 clay tablets stored in the archives of Ebla (modern Tell Mardikh, Syria) dating from approximately 2250 BCE [2] and the hundreds of thousands of papyrus rolls--estimates range from 200,000 to 700,00--stored in the Great Library of Alexandria [3]. Although natural and man-made disasters destroyed many of these ancient records, others have been preserved naturally and discovered accidentally, including the Dead Sea Scrolls written on parchment, dating from approximately 250 B.C. to about 65 A.D., and discovered in caves along the shores of the Dead Sea from 1947 to 1956 [4].

Today's technology has placed the task of creation and dissemination of information into the hands of many but in doing so has made the task of capturing and preserving information more complex than at any time in our history.

The amount of information created worldwide in digital format surpassed 1.8 zettabytes (1.8 billion terabytes) during 2011. By 2020, the world will generate 50 times that amount. This digital data is generated by "numerous devices in numerous forms: remote sensors, online retail transactions, text documents, e-mail messages, web posts, camera and video images, computers running large-scale simulations, and scientific instruments such as particle accelerators and telescopes" [5].

It is not surprising that there is a rapidly increasing demand for information professionals who can manage the burgeoning data generated by the nation's researchers, serve as stewards of the nation's cultural legacy, and meet the needs of businesses and government agencies as they manage their growing volume of digital assets. This relatively new and pressing need has created a rising demand for archivists, librarians, and museum professionals who are trained to apply the latest tools and methods to effectively manage and preserve material that is born digital or converted to digital form.

According to the Occupational Outlook Handbook, 2010-11 Edition, employment of digital curators is expected to increase by 23% between 2008 and 2018, which is much faster than the average for all occupations.

In 2007 digital curation was recognized as a new, umbrella concept that includes digital preservation, data curation, electronic records management, and digital asset management. Digital curators were labeled as the newest type of information professional on the block [6].

However, six years later, the call for contributions on the DigCurV 2013 international conference website describes digital curation as "a central challenge and activity for libraries, archives, museums and other cultural organizations" [7]. In 2012, Abreu, Acker, and Hank, acknowledged that "planning and managing digital collections for current and future access and re-use is [still] a significant challenge in our contemporary information landscape, transcending sub-domains under the umbrella of information science, including the fields of archives, digital preservation and curation, and records management"[8].

These challenges can only be met by educating all users of the need to identify, capture, manage, organize, use and reuse, add value to, and preserve information—i.e., master the core competencies required for each phase of the digital curation lifecycle.

This position does not negate the need for digital curators but insists a dual approach to digital curation education is called for: 1) digital curation education and training programs to train digital curators and 2) an infusion of digital curation competencies into the SLIS curriculum for everyone else. This paper addresses the second approach.

II. DIGITAL CURATION COMPETENCIES

In the US, the Institute of Museums and Library Science has funded the development of digital curation programs in graduate schools since 2006. The funding has supported the development of robust programs (including core curricula, specialized elective courses, and required internships in established digital repositories) in a number of institutions, including the University of Illinois Urbana Champaign, the University of North Carolina at Chapel Hill, and the University of Tennessee [9]. But other universities and institutions, including the School of Library and Information Science at San Jose State University, have not followed this path for a number of reasons.

Qualifications listed for jobs that contain "curator" in the title often vary widely. And job openings that do not contain the term "Curator" in the title often require digital curation skills and knowledge.

The DCC Curation Lifecycle Model [10] includes the following sequential actions: conceptualize; create or receive; appraise and select; ingest; preservation action; store; access, use, and reuse; and transform. It also identifies the following occasional actions: dispose, reappraise, and migrate.

The foundation of the Digital Curation Center (DCC) reflected the belief that long-term stewardship of digital assets is the responsibility of everyone in the digital information value chain [11]. Although the DCC is mainly focused with "data" curation, other types of information objects must be managed throughout their lifecycle.

An analysis of the jobs posted to the Digital Curation Exchange on February 5, 2013, revealed the diversity of the opportunities for digital curators [12]. Of 29 listings posted between January 1, 2013 and February 5, 2013, there were no job titles that used the term "digital curator." However one listing announced a position for a *Director of Research Data Curation Service.* Examples of job titles include: King County Archivist, Institutional Repository Coordinator, Emerging Technologies Librarian, and Digital Asset Metadata and Taxonomy Specialist.

In addition to developing Centers of Professional Digital Curation Training and Education, such as the Certificate in Digital Curation offered by the School of Information and Library Science at the University of North Carolina, a proactive approach is needed to integrate digital curation knowledge and skills within all library and information science programs of study.

In this digital age, disciplines that once found little common ground, now find their roles converging when it comes to the care and preservation of digital assets. To encompass the widest audience possible, Digital curation can be broadly interpreted as "maintaining and adding value to a trusted body of digital information for current and future use [13].

And when identifying core competencies for SLIS curriculum, the Delphi common definition of digital curation is used:

"Digital curators are individuals capable of managing digital objects and collections for long-term access, preservation, sharing, integrity, authenticity and reuse. In addition they have a range of managerial and operating skills, including domain or subject expertise and good IT skills." [14]

Table 1 describes two required and five elective SJSU SLIS courses and maps them to the phases of the Digital Curation Lifecycle based on an analysis of the most recent syllabus posted for each.

These courses were not designed as part of a digital curation curriculum but as courses either required of all students or elective courses open to all students and strongly recommended for students following either the digital services and management career pathway or the digitization and preservation of cultural heritage and records (archival studies and records management) career pathway.

Yakel, Conway, Hedstrom, and Wallace identify three components of a strong curriculum for digital curation as: 1) coursework, 2) practice-based internships, and 3) a solid technology infrastructure [15.] Tammaro, Casarosa, and Madrid (2012) organized twenty digital curation core competencies identified through a Delphi Study into ten operational competencies and ten managerial competencies that digital curators should possess [16].

The phases of the Digital Curation Lifecycle to which SJSU / SLIS courses have been mapped are:

1 – Conceptualize
2 – Create or Receive
3 – Appraise & Select
4 – Ingest
5 - Preservation Action (e.g., migration, emulation)
6 – Store
7 – Access, Use, & Reuse
8 – Transform
9 – Preservation Planning

The seven courses included in Table I support various phases of the digital curation lifecycle. Both LIBR 202 (3 units of credit) and LIBR 203 (1 unit of credit) are required of all students. The five additional courses are taught as special topics under the LIBR 284 – Seminar in Archives and Records Management course category.

TABLE I . SJSU / SLIS COURSES MAPPED TO PHASES OF THE DIGITAL CURATION LIFECYCLE

Course Designator & Title	Course Description and Link to a Recent Syllabus	Digital Curation Lifecycle Phases (Area 4) *(major focus)*
LIBR 203 Online Social Networking Technologies and tools (Required: 1 unit of credit)	This course introduces students to a variety of new and emerging technologies used in today's online environment. It covers various social networking platforms, content and learning management tools, web conferencing, and other trends in social computing. Link to syllabus: http://slisapps.sjsu.edu/gss/ajax/showSheet.php?id=4976	2 – Create or Receive 4 – Access, Use & Reuse 6 - Store
LIBR 202 Information Retrieval (Required: 3 units of credit)	Principles of information retrieval and their application to information systems and services. Emphasizing models of user information seeking behavior, human information processing and their relationship to retrieval models in information systems. Link to syllabus: http://slisapps.sjsu.edu/gss/ajax/showSheet.php?id=4970	1 – Conceptualize 2 – Create or Receive 3 – Selection & Appraisal 4 – Access, Use & reuse
LIBR 284 Seminar in Archives & Records Management *Topic: Characteristics and Curation of New Digital Media*	In this course, we will explore approaches to the collection and curation of selected new digital media in libraries and other cultural repositories. In the first stage of the course, roughly the first four weeks, the focus will be on developing an understanding of the characteristics of new media and refining what we mean by the term "curation." The second stage will make up most of the course, consisting of five two-week engagements with five specific media and issues associated with them. Each of the five media will be paired with a specific issue about the impact of games on curation – selection/appraisal, acquisitions, description/archiving, preservation, and access/exhibition. Link to syllabus: http://slisapps.sjsu.edu/gss/ajax/showSheet.php?id=4938	1 – Conceptualize 2 – Create or Receive 3 – Selection & Appraisal 4 - Ingest 5 – Preservation Action (emulation) 6 - Store 7 - Access, Use, & Reuse 9 – Preservation Planning

LIBR 284 Seminar in Archives & Records Management

Topic: Digitization and Digital Preservation | This course will provide an introduction to the digitization of archival, library, and museum materials, as well as an introduction to the digital preservation of the resulting digital objects. Students will learn about using digital technologies to provide better access to and sometimes to preserve text, images, sound, and video. [Please note: the majority of the course will focus on the digitization of text and image because of the nature of this class and equipment requirements.] Particular topics to be explored in depth include: selection for digitization, legal and copyright issues, digitization requirements for text and images, metadata, and technology issues. The course will provide a broad foundation of the principles, processes and standards guiding the digitization of cultural heritage materials.

Link to syllabus: http://slisapps.sjsu.edu/gss/ajax/showSheet.php?id=5144 | 2 – Create & Receive

3 – Appraise & Select

6 - Store

7 – Access & Use

9 – Preservation Planning |
| LIBR 284 Seminar in Archives and Records Management

Topic: EAD | This class will cover in-depth Encoded Archival Description (EAD), and provide a brief introduction to Encoded Archival Context (EAC), the international standards for the presentation of archival descriptive information and records creator authority records on the World Wide Web.

Link to syllabus: http://slisapps.sjsu.edu/gss/ajax/showSheet.php?id=5137 | 2 – Create or Receive (metadata)

7 – Access, Use, & Reuse |
| LIBR 284 Seminar in Archives and Records Management

Topic: Electronic Records Management | This course is an introduction to the management and long-term preservation of unstructured content created or maintained electronically. This course examines the ways in which new information technologies challenge organizations' capacities to define, identify, control, manage, and preserve electronic records. Topics include the nature of electronic records as evidence; reliability and authenticity in electronic records; electronic records management policy formulation; business continuity planning; information security; the role and nature of recordkeeping metadata; strategies, techniques, and technologies for the long-term preservation of electronic records; individual electronic recordkeeping behaviors, as well as industry, national, and international standards relating to electronic recordkeeping.

Link to syllabus: http://slisapps.sjsu.edu/gss/ajax/showSheet.php?id=5141 | 6 – Store

7 – Access, Use, & Reuse

9 – Preservation Planning |
| LIBR 284 Seminar in Archives and Records Management

Topic: Managing Photographic Collections | This class will examine issues involving managing photographic collections in archives. Topics covered will include photographic process identification, visual literacy, arrangement and description, storage/preservation needs, access, reference, digitization, rights and reproductions, curation, and born-digital image archives. *Note: This course applies to both analog and digital collections.*

Link to syllabus: http://slisapps.sjsu.edu/gss/ajax/showSheet.php?id=5139 | 2 – Create or Receive

3 – Appraise & Select

7 – Access, Use, & Reuse

8 – Transform (for website or display space) |

Each of the three components, two of the ten operational competencies, and two of the ten managerial competencies are used in Section III to demonstrate how digital curation competencies are integrated into the SLIS program at San Jose State University.

III. COMPONENT #1: CURRICULUM

Fourteen core competencies provide the foundation for the MLIS program offered through the School of Library and Information Science at San Jose State University. These competencies are supplemented by student learning outcomes specific to the various career pathways. Of the twelve career pathways offered to provide guidance in the selection of elective courses, the one selected by students seeking careers related to digital curation is *Management, Digitization, and Preservation of Cultural Heritage and Records (Archival Studies and Records Management)*.

Three of the MLIS core competencies that are of value to students preparing to assume digital curation responsibilities are:

- (D) Apply the fundamental principles of planning, management, marketing, and advocacy

- (F) Demonstrate understanding of basic principles and standards involved in organizing information including classification, cataloging, metadata, or other systems

- (G) Demonstrate proficiency in identifying, using, and evaluating current and emerging information and communication technologies

A. Operational Competencies

Two of the ten operational competencies identified by the Delphi Study are listed in the first column of Table II, along with a letter designating the corresponding MLIS core competency. One example of a SLIS course that supports each competency is listed in column 2.

LIBR 259 - Preservation Management - Digital provides an examination of preservation practice, with an emphasis on emerging theories, models and technologies. It is a foundation course for students pursuing the *Management, Digitization and Preservation of Cultural Heritage and Records* career pathway.

LIBR 202 – Information Retrieval introduces the principles of information retrieval and their application to information systems and services with an emphasis on user information seeking behavior, human information processing and their relationship to retrieval models in information systems. This course is required of all SLIS students.

TABLE II. OPERATIONAL COMPETENCIES AND SLIS COURSES

Competency	Course(s)
Selects and appraises digital documents for long-term preservation **Comp F at SJSU/SLIS**	*LIBR 259: Preservation Management—Digital Only*
Is aware of requirements to information infrastructure in order to ensure proper access, storage and data recovery. **Comp G at SJSU/SLIS**	*LIBR 202: Information Retrieval*

B. Managerial Competencies

Two of the ten managerial competencies identified by Tammaro, Casarosa, and Madrid are listed in the first column of Table III, along with a letter identifying the corresponding MLIS core competency. One example of a SLIS course that supports each competency is listed in column 2.

LIBR 282 – Seminar in Library Management—Digital Asset Management is designed to introduce students to the fundamental concepts, terminology, practice and application of digital asset management in the public and private sector. It will feature discussions on metadata, workflow, taxonomy, data security, and preservation of digital assets.

LIBR 284: Seminar in Archives and Records Management— EAD provides an in-depth overview of Encoded Archival Description (EAD) and a brief introduction to Encoded Archival Context (EAC), the international standards for the presentation of archival descriptive information and records creator authority records on the World Wide Web.

TABLE III. MANAGERIAL COMPETENCIES AND SLIS COURSES

Competency	Course(s)
Plans, implements, and monitors digital curation projects. **Comp D at SJSU/SLIS**	*LIBR 282: Seminar in Library Management—Digital Asset Management*
Organizes and manages the use of metadata standards, access controls and authentication procedures **Comp G at SJSU/SLIS**	*LIBR 284: Seminar in Archives and Records Management--EAD*

We can look to the success of students in the workplace to support our contention that digital curation competencies have been infused in the curriculum in a way that is meaningful for students. In Figure 1, Matt Carmichael explains how the skills and knowledge he gained by taking MLIS courses prepared him for his work in a museum.

Example of Student Applying Digital Curation Skills and Knowledge in a Museum Setting

On the topic of digital curation, Matt Carmichael states, "Digital curation is a new concept for many museum professionals and is a more inclusive concept than digital archiving and digital preservation." In his position, Matt used the knowledge and skills he developed through SLIS coursework to design a digitization policy that included a long-term plan for managing digital content. When asked which were the courses that best prepared him for his position at the History Museum, Matt listed *LIBR 259 – Preservation Management*, *LIBR 284-Seninar in Archives and Records Management, Topic: Digital Asset Management*, and *LIBR 284-Seminar in Archives and Records Management, Topic: Digital Curation of New Media*.

Figure 1. Excerpt from Matt Carmichael's Community Profile at http://slisweb.sjsu.edu/people/community-profile/matt-carmichael

IV. COMPONENT #2: INTERNSHIPS

SLIS currently offers more than 150 internship opportunities each semester for students in the MLIS degree. Students learn of these pre-approved opportunities by searching the SLIS Internship Database and apply for the positions following the instructions provided by the site. If offered a position, students then apply for approval to register for a SLIS internship course. Permission is granted once the student, site supervisor, and faculty internship supervisor agree upon at least three learning outcomes the student will achieve by the end of the internship experience. The course description follows:

LIBR 294 - Professional Experience: Internships (Archival section) is a field-based learning experience that takes place with an archives or other archives-related information-based organization. It allows the student to obtain work experience while pursuing stated learning outcomes. It is designed to provide the student the opportunity to test theories and to practice skills learned in the student's program.

The Internship course can be taken for 2, 3, or 4 units of credit; each unit is equivalent to 45 hours of work. The internship location can be on site, virtual or a combination.

Place-based Internship Experiences:

The benefits to students of engaging in a place-based internship experience include the ability to apply what they have learned within a professional setting, while building beneficial connections with potential future employers. Sixty-six archival listings are included in the database for spring 2013. One example is provided in Figure 2.

The California State Archives
Type of Library: Archives
Website: www.sos.ca.gov/archives/
Location: 1020 O Street, Sacramento, CA 95814

Job Title: Processing Student
Job Description: Under direction of professional staff, students will: complete internal training program, organize historical collections according to standard principles and practices, carry out routine preservation activities, and describe collections using standard format.

Figure 2. Place-based archival Internship listing from the SLIS database.

Student experiences are documented through Community Profiles posted on the SLIS website. The example provided in Figure 3 is an excerpt from an online Community Profile documenting the student's internship experience at NASA.

Example of Student Intern for NASA

Alumna Ratana Ngaotheppitak's seven-month internship at the NASA Ames Research Center helped her secure a job as a NASA Archivist. During her Fall 2010 archives internship, Ngaotheppitak worked with a collection documenting one of the "human computers" at the National Advisory Committee for Aeronautics (NACA) in the 1940s and 1950s. She processed the Amelia Reid Papers from start to finish by completing the accession record, taking an inventory of the materials, performing preservation work, creating a finding aid and a MARC record, and encoding the finding aid for display in the Online Archive of California.

Figure 3. Excerpt from Ratana Ngaotheppitak's community

profile at http://slisweb.sjsu.edu/community-profile/ratana-ngaotheppitak

Virtual Internship Experiences: Until the fall of 2010, most of SLIS internships were place-based and as a result, students needed to live near an approved internship site or work with the SLIS internship coordinator to identify an acceptable internship site near their home. This arrangement presented obstacles for many of the School's MLIS students, as the graduate program is delivered fully online, and the School's 2,200 students live in 45 states, as well as in Canada and other nations.

The solution proposed was to develop a virtual internship program, which would allow students to live anywhere and take advantage of a wide range of internship opportunities, regardless of the geographic location of the student or the internship sponsor.

In the fall of 2010, a survey was conducted of 78 internship site supervisors who had participated in the SLIS internship program over the prior three years to determine their needs for digital curation virtual interns. Twenty-five respondents indicated they expected to have a digital curation project within their organization within the next three years and would consider hosting an internship.

Example of Virtual Student Intern

Student Martina Podsklanova, of Belfast, Ireland, was the 2012 recipient of the SLIS NewsBank Scholarship, which helped support her during her fall 2012 virtual internship at Calisphere, an online portal of digitized images of historical artifacts from California repositories. Podsklanova concentrated on improving user access and enhancing the online visibility of Calisphere through current strategies, including search engine optimization (SEO) and the analysis of web metrics. In an interview before the fall internship, Podsklanova said, "The web is the first place researchers go to find a repository or look for documents. Archivists need to create a solid metadata system so users can find the information online, and that's what I'll be doing in my internship."

Figure 4. Virtual archival Internship Listing from the SLIS database.

California State University grant funds were used to support work over the summer of 2011 to identify virtual internship positions, and develop a framework for virtual internships to ensure students could successfully participate at a distance and

site supervisors would be able to assess learning outcomes. During the fall of 2011, virtual internship materials were assembled for students and site supervisors, and several site supervisors participated in a virtual internship panel presentation via web conferencing to introduce students to the concept of virtual internships within their organizations.

The first section of LIBR 294 exclusively for students participating in virtual internships was offered in spring 2012, and 15 students enrolled. One of the 27 virtual internship listings in the SLIS database at that time is shown in Figure 4.

Students taking online courses are uniquely prepared for virtual interships. They are motivated self-starters who are comfortable with communication and information systems. The personal qualities that help them successfully complete online courses can be employed to succed in virtual internship placements. In Figure 5, a virtual intern shares her perspective on her internship experience.

Stanford University Archives
TYPE OF LIBRARY: Archives
WEBSITE:
library.stanford.edu/depts/spc/uarch/index.html
LOCATION: Green Library, 557 Escondido Mall, Stanford, CA 94305
JOB TITLE: EAD Recon Intern
JOB DESCRIPTION: Under the direction of the University Archivist the EAD Recon Intern will convert legacy collection inventories (Word, FileMaker Pro, paper) into EAD using Excel, Acrobat, Oxygen, and Archivists' Toolkit.

Figure 5. Excerpt from Martina Ngaotheppitak's Community Profile at http://slisweb.sjsu.edu/people/community-profile/podsklanova

The Internship Course involves more than work experience. Students enroll in the course, participate in discussions taking place in a learning management system, and submit a final report describing their experience and providing evidence they have achieved the learning outcomes they agreed upon with the site supervisor at the beginning of the course. In order to foster a sense of community, virtual interns are also required to maintain a blog describing their internship experience through weekly posts and attend at least two of five scheduled web conferences over the course of the semester.

V. Component #3: Technology Infrastructure

The MLIS degree program is 100% online. Students must complete an online social networking course that introduces them to a variety of new and emerging technologies used in today's online environment. The course covers various social networking platforms, content and learning management tools, web conferencing, immersive environments, and other trends in social computing. That introduction and the manner in which all SLIS courses are taught utilizing social media and emerging technologies exposes students to the importance of creating, managing, using, accessing, and preserving digital objects—the artifacts they create throughout their program.

Technology all SJSU/SLIS students are introduced to:

- Blackboard Instant Messaging
- Blackboard Collaborate (web conferencing)
- Desire2Learn Learning Management System
- DB/Textworks
- Gmail
- King Library Online Resources
- Microsoft Office (Word, PowerPoint, Excel, Outlook)
- MySJSU (student management system)
- SJSU Student E-mail Accounts
- SPSS software (data collection, statistics, modeler, and analytical decision management)

Access to a number of services and databases is provided to students based on the courses in which they are enrolled, including CALI, Dialog, Factiva, Gale, LexisNexis, LibGuides, NoveList, OCLC, ProQuest, Refworks, Web of Knowledge, Westlaw, and NoveList.

Technical support is provided to students via online resources and support staff.

VI. Conclusion

Digital curators manage, maintain, preserve, and add value to digital data, reduce threats to long-term value, mitigate the risk of digital obsolescence, and enhance the usefulness of digital data for research and scholarship.

Digital curation begins during the planning stage and should be a consideration throughout each stage of the digital curation lifecycle. Although the demand for digital curators is growing, the capacity to educate and train digital curators does not exist.

Students in the School of Library and Information Management's MLIS program are exposed to digital curation competencies throughout their program, through both required and elective courses. They also have the opportunity to select from more than 60 archival internship opportunities through the SLIS database each semester. In addition, because the MLIS program is 100% online, the students are comfortable with information and communication technology and understand the importance of creating, managing, accessing, using, and preserving their own digital assets.

Infusing digital curation core competencies into the SLIS curriculum will expand the number of professionals prepared to perform digital curation activities in order to protect, add value to, and preserve our digital assets.

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