

## **Digital Information Curation for 21<sup>st</sup> Century Science and Scholarship: Experience-Based Learning for Information Professionals and Disciplinary Researchers**

The evolving landscape of scholarly production presents academic libraries with new opportunities for curating, managing, and preserving the inputs and outputs of research and scholarship. Requirements by federal funding agencies for explicit plans for managing research data (see National Science Foundation, 2010) offer academic libraries new roles in collaborating with other campus units in providing institutional responses for data management. Reports such as *Harnessing the Power of Digital Data for Science and Society* (National Science and Technology Council, 2009) and those addressing cyberinfrastructure from the National Science Foundation (2003, 2005, 2007) herald a new era in scholarship and research using digital technologies and data. A recent report by Soehner et al. (2010), however, indicates gaps in academic libraries, particularly with appropriately trained information professionals, to act on the opportunities for supporting cyberscholarship in the areas of digital curation and data management.

The proposed initiative's goal is to *build capacity in UNT's Library and Information Sciences (LIS) curriculum to increase the number of appropriately trained information professionals and disciplinary researchers and scholars for digital curation and data management responsibilities*. The College of Information and the Libraries at the University of North Texas (UNT) will build upon recent IMLS-funded projects that developed curricula and programs in digital curation, digital librarianship, and digital preservation. Our initiative integrates principles of sound pedagogy, instructional design, and a learning environment that emphasizes practical training, experiential learning, and active experimentation. In brief, we propose to:

- Develop a Graduate Academic Certificate<sup>1</sup> with four courses in Digital Curation and Data Management.
- Deploy a robust technical infrastructure to support student learning, practical engagement, and training.
- Implement a virtual teaching environment for students' active experimentation and discovery learning.

The increasing web-based delivery of LIS graduate education presents challenges for ensuring sufficient "hands-on" training and real-world problem engagement. Our virtual teaching environment is inspired by the teaching hospital model, which is characterized by: direct engagement with real-world problems (e.g., patients); extensive hands-on training (e.g., diagnosis of patient illness and problem-solving); and expert-supervised student learning (e.g., attending physician).

The education and training needs of three primary groups are the focus of this initiative:

- Graduate students in UNT's LIS Masters program majoring in Information Science.
- Post-masters information professionals who need retraining for digital curation responsibilities.
- Discipline-specific graduate students (e.g., engineering, sciences, humanities, etc.) who may be responsible for managing data for scientific and scholarly projects.

The proposed initiative leverages the results of recent and existing IMLS-funded projects, builds upon the strengths of several learning theories, and includes a multi-component technical infrastructure in which students can gain practical training. It uses an iterative process of *design, implement, assess and evaluate, and revise* for the courses and technical infrastructure to continuously improve all parts of the students' learning and practical training experiences. It seeks to answer the basic question: *In the context of distributed learning and web-based courses, how can LIS education be changed and enhanced to incorporate extensive training and practical experience to result in well-prepared information professionals, scientists, and scholars to take on the challenges and problems of digital curation, data management, and digital preservation?*

### **Assessment of Need**

The nature of academic work across many disciplines is changing. At the core of these changes are digital technologies, data, and information: the lifeblood of the 21<sup>st</sup>-century university for teaching, learning, and the myriad scholarly activities of scientists and scholars. Data-driven research using large-scale datasets (whether

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<sup>1</sup> At UNT, a Graduate Academic Certificate program is taught by UNT graduate faculty, composed of graduate-level credit courses and documented on official transcripts. It serves as official evidence of a concentrated area of study.

numeric, textual, image, or audio) enables scientists and scholars to pose and answer problems in new ways. This new “cyberscholarship” challenges traditional LIS education to adequately prepare information professionals, particularly academic librarians, to be key participants in these activities. Cyberscholarship encompasses “new forms of research and scholarship [ ] qualitatively different from traditional ways of using academic publications and research data” that are enabled by the “widespread availability of digital content” (Arms & Larsen, 2007).<sup>2</sup> It relies on a robust infrastructure – human, policy, and technical – that supports digital information throughout the life cycle of knowledge creation and dissemination, with particular attention to its stewardship for reuse and long-term access.

Current scholarly activities are using and creating tera- and petabytes of data, which at some point may land at the library’s doors to manage and make available for future researchers – a possibility made even more likely by federal funding agencies’ requirements for data management plans for preservation, access, and reuse of publicly funded research results. This need aligns perfectly with digital curation which “involves maintaining, preserving and adding value to digital research data throughout its lifecycle” (DCC 2010) for both current and future use (Pennock, 2007). To help provide for source data access and to effectively shepherd information through its life cycle, academic libraries need personnel who understand digital curation both theoretically and practically. Yet, even as there is a growing demand for training in digital information curation – especially understanding of the range of disciplinary requirements for storing, accessing and using this information in academic environments – few professional programs prepare students (especially those in distributed, online programs) with sufficient practical training and learning experiences that directly engage them in the kinds of real-world curation and data management issues faced by librarians, scientists, and scholars.

### **Research Libraries’ and Librarians’ Preparedness for Curating Digital Information**

The Association of Research Libraries (ARL) E-Science Working Group surveyed ARL members in 2009 to determine existing levels of institutional preparedness to address demands of cyberscholarship activities in science. The resulting report (Soehner et al., 2010) depicts varying levels and types of activity to address e-science; only two of 57 respondents indicated that their library already has a unit for addressing e-science issues. Common obstacles to meeting the demands of e-science are “lack of resources, *difficulty acquiring the appropriate staff and expertise to provide e-science and data management or curation services*, and the lack of a unifying direction on campus” (p. 8, emphasis added). Despite current budget shortfalls, many ARL libraries surveyed are training existing staff, hiring new staff, and developing new positions to support services around e-science, indicating the critical importance these institutions place on supporting cyberscholarship.

In 2010, as part of the IMLS-funded *Classification of the End-of-Term Archive* project, the UNT Libraries administered an online survey to 1225 libraries in the Federal Depository Library Program to gauge interest in acquiring versus accessing Web archive materials and to estimate capacity for supporting acquisition services. On average, the 414 librarians participating in the survey, representing primarily mid-sized academic libraries, gave low marks to their institution’s preparedness for curating Web resources. On a scale of 1 to 7 (1=not capable and 7=extremely capable), the median ranking was 2 for capacity for hosting and user access and for supporting digital preservation. In their comments, participants blamed limited resources as a leading impediment to supporting Web archive materials, closely followed by lack of staffing (Murray, 2010).

A separate survey conducted by the UNT College of Information in 2010 targeted librarians at the 200 academic institutions that have received the most NSF funding for the past three years (see *Supporting Documentation* for survey questions, results, and list of institutions surveyed). This survey gauged librarians’ expectations and perceptions of research data management at their institutions. Presented with various possible roles for libraries in managing research data, most respondents indicated that, at their institution, it would be “very useful” or “critical” for the library to serve in these roles. A few respondents expressed concern that the library’s ability to fill such roles depends on broader institutional support. As one librarian observed,

The above selections reflect what the roles "are likely to be at your institution." The selections do not reflect my thoughts of what should be. Several library administrators approached science department chairs about the role of

<sup>2</sup> In this proposal, other nuanced terms for new forms of scholarship (e.g., digital scholarship, e-science, digital humanities) are incorporated into the cyberscholarship concept.

the Library in data curation and were told in no uncertain terms that the scientists know how to handle their data and do not need help from librarians. Perhaps our social scientists will be more amenable to help from the Library.

### **Professional Training in Digital Information Curation**

Writing on the specific challenges faced by science librarians, Marlino and Sumner (2009) wonder, “Will librarians be able to insert themselves into the emerging processes of e-sciences or will the scientists and students bypass librarians and their potentially valuable services and go it alone?” (p. 195). A related question is whether LIS education can prepare and train information professionals to lead the way. Part of this preparation should necessarily involve direct engagement with researchers and the digital information that libraries may eventually curate. Yet when Zorich (2008) listed the academic departments affiliated with digital humanities centers in terms of education and other activities, LIS programs were not among them, although computer science and engineering were.

Ambivalence about the value of LIS training has been found in job requirements for digital librarian positions. In Choi and Rasmussen’s (2009) study, digital librarian positions were less likely to require an ALA-accredited degree than other librarian positions in similar studies (e.g., Shank, 2006; White, 1999). Soehner et al. (2010) found that of the e-science positions that listed degree requirements, 72% ( $n=64$ ) listed library and information science at the master’s or PhD level but commented: “One recent posting required an ‘ALA accredited master’s degree in library or information science,’ while another required ‘demonstrated expertise in data management or information science. This would preferably take the form of direct experience with data curation/management, but could include an MLS/MLIS degree with an emphasis on data management’” (p. 8). Another job postings analysis (Cragin et al., 2009) found that among institutions looking for professionals with data curation skills academic libraries make up 55.8% and research or data centers make up 28.3% of the postings. Almost half of these postings required an ALA-accredited master’s degree. Choi and Rasmussen (2009) recommended that “professional education programs should provide hands-on experience via coursework, practicum, or internship programs” (p. 466). This corresponds with earlier findings from a survey of 48 digital librarians at U.S. academic libraries; the authors recommended LIS education incorporate practical skills and experience with the collections and tools of digital libraries (Choi & Rasmussen, 2006).

### **Partnerships and Problem-Solving in Online Learning Environments**

Respondents to the 2010 UNT College of Information survey overwhelmingly affirmed (92%,  $n=61$ ) that LIS programs and academic libraries should work together to provide certification opportunities in research data management, for researchers and students across disciplines as well as library professionals and librarians in-training. Among the 39 additional comments for this question, several underscored the critical importance of including input from people already involved in data management.

There is room for growth in partnerships between libraries, museums, and LIS programs, but there have been efforts in this direction, for example: the Digital Curriculum Laboratory (DCL) at the Simmons College Graduate School of Library and Information Science (GSLIS) (Bastian, 2010); the *Making It REAL!* Project at the New York State Library (Todd, 2007); the DigCCurr initiative at the University of North Carolina (<http://www.ils.unc.edu/digccurr/index.html>); and the Pratt Institute’s Chart Project ([http://www.pratt.edu/academics/information\\_and\\_library\\_sciences/grant\\_scholarship\\_internship/chart/](http://www.pratt.edu/academics/information_and_library_sciences/grant_scholarship_internship/chart/)). Discussing the collaborative construction of the GSLIS DCL, Bastian (2010) notes the still evolving nature of digital curation curricula, and the need for virtual laboratories in LIS programs where students can experience and engage the digital issues they will face in actual work environments. Tibbo, Hank, and Lee (2008) assert that “programs should emphasize practical experience, ranked as the most important attribute when considering job applicants for digital curation professional positions, followed by technical skills.”

Initiatives have begun addressing the gaps in LIS curricula to better prepare librarians for the technological changes in the methods of cyberscholarship. DigCCurr (<http://www.ils.unc.edu/digccurr/index.html>), an IMLS-funded project, recently released an internationally adaptable LIS curriculum for digital curation and has offered professional development workshops for training existing librarians (Hank et al., 2010). Another IMLS-funded initiative, the Digital Information Management (DigIn) certificate program at the University of Arizona (SIRLS,

2008) offers an online certification program for librarians and under-served cultural and ethnic groups. Pomerantz, et al. (2009) suggest using digital library applications in the process of teaching and applying concepts of digital libraries. Considered together, these new models and methods point to the possibility of providing online learning environments where digital curation curricula can be taught through problem-based, open-ended interactions with the people, data, and tools of cyberscholarship. LIS partnerships with libraries can potentially provide practical experiences. Yet current arrangements often limit collaboration among the partners; for example, the favored mechanisms for practical experience (practica, internships, or summer institutes) are often introduced at the end of the program. We are proposing to embed the practical training and learning experiences at each step in the students' learning process by employing the teaching library model, which also includes engagement with real-world problems to reinforce student learning.

## Impact

The following anticipated and intended impacts are framed by our overarching question: *In the context of distributed learning and web-based courses, how can LIS education be changed and enhanced to incorporate extensive training and practical experience to result in well-prepared information professionals, scientists, and scholars to take on the challenges and problems of digital curation, data management, and digital preservation?*

- Demonstrate how practical training of LIS students can be accomplished through a collaborative effort by UNT LIS and the UNT Libraries, which will provide the opportunities for students to engage with real-world problems and with the Libraries' technology infrastructure and tools, and digital data in a variety of formats.
- Build workforce capacity by increasing the number of well-prepared information professionals to assume digital information curation, management, and preservation responsibilities. By the end of the project, we project at least 20 information science graduate students and 10 post-masters information professionals will complete the Graduate Academic Certificate (GAC) in Digital Curation and Data Management.
- Build educational capacity by expanding and enhancing UNT's LIS curriculum for Information Science majors with four new graduate courses focused on digital curation and data management. This corresponds with our recent curriculum review and current re-articulation of the Information Science major (see *Supporting Documentation* for brief description of the three-tier LIS curriculum structure).
- Provide extensive practical training of students through innovative instructional design and learning experiences through a Virtual Teaching Environment and associated Digital Curation Sandbox.
- Gain experience and knowledge in using a Virtual Teaching Environment through which distributed learning students can develop knowledge, skills, and competencies by engaging with faculty and practitioners to address real-world problems of digital curation, data management, and digital preservation.
- Offer training to discipline-specific graduate students to provide them with the fundamentals of cyberinfrastructure and cyberscholarship. A targeted objective of bringing in these students is to nurture relationships between them and the information professionals-in-training. We project at least 15 discipline-specific students will take at least one of the courses in this specialization.

In part, our vision for practical training and engagement with real-world digital curation and data management problems will be actualized by transferring key aspects of the teaching hospital model to the virtual teaching environment. A teaching hospital model to enhance learning has been attempted in several disciplines. Goel et al. (2006) describes an effort to implement such a model in the area of information assurance. The table below illustrates the mapping of the medical teaching hospital model for information assurance into the ideas proposed for digital curation and data management training.

ASPECT	Medical Teaching Hospital	Teaching Library
Purpose	1. Teach Medicine 2. Cure Patients 3. Develop New Cures	1. Hands-on experience in skills and competencies needed for 21st century digital curation and data management 2. Problem-based learning applied to solve real-world issues 3. Improved learning outcomes and more prepared information professionals
Location	Hospital	The Virtual Teaching Environment and the Digital Curation and Data Management Sandbox
Supervisors	Medical doctors	LIS faculty and library faculty/practitioners

ASPECT	Medical Teaching Hospital	Teaching Library
Students	Medical students/residents	Multi-disciplinary graduate-level students
Clients	Medical Patients	Academic libraries and discipline-specific researchers

There are obvious differences between a teaching hospital and a teaching library, especially in the context of digital curation and data management. We will be systematically investigating questions about the nature, features, functions, and character of the Virtual Teaching Environment to support the learning experiences of the students. Results from our work can help inform how other LIS programs may increase their capacity to address the necessary practical preparation of information professionals using a teaching library approach.

## Diversity Plan

UNT's cohort-based distributed learning model serves students in more than 10 states and varying circumstances, including remote and/or rural areas. In collaboration with the UNT cohort coordinators, we will actively recruit students and current librarians from underrepresented groups. For the discipline-specific students, we will recruit students from the sciences, humanities, arts, social sciences, and engineering, another aspect of diversity. In evaluating the project's success, we will pay particular attention to diversity factors.

## Project Design and Evaluation

A collaborative project team comprising LIS faculty members and UNT Libraries professional staff will work together in curriculum development and teaching library implementation for this three-year capacity-building project. The *Schedule of Completion* provides the project timeline. The project's major components are:

- Curriculum Development and Instructional Design
- Technical Infrastructure for Directed, Active Experimentation, and Discovery Learning
- Recruitment
- Project Management and Dissemination
- Evaluation and Assessment

## Project Design

### Work Area A: Curriculum Development and Instructional Design

Encompasses all aspects of design, development, implementation, assessment, and refinement of four courses that will comprise a GAC in Digital Curation and Data Management. A critical and high-value aspect of this project is the use of innovative instructional design and pedagogy to create excellent learning experiences for students engaging with these web-based courses. Each course will have articulated learning objectives and measurable outcomes, developed in conjunction with UNT's Center for Learning Enhancement, Assessment, and Redesign (<http://clear.unt.edu/>). The team will develop two courses each in Project Years 1 and 2. Each course will be revised as necessary and offered at least three times during the project.

LIS faculty members and UNT librarians will develop, implement, and assess, in an iterative design approach, four web-based graduate courses (see *Supporting Documentation* for preliminary descriptions):

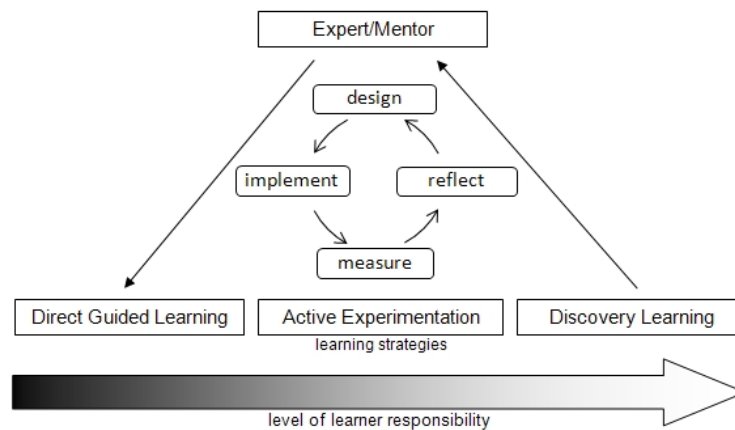
- Course 1: Cyberinfrastructure Fundamentals for Digital Curation and Data Management
- Course 2: Technology Infrastructure, Tools, and Applications for Digital Curation
- Course 3: Managing and Preserving Digital Data and Information
- Course 4: Digital Curation and Data Management Seminar

As illustrated below, the instructional design for the courses and students' learning experiences is based on three learning strategies, with increasing responsibility by the student for his/her own learning (see *Supporting Documentation* for description):

- Direct Guided Learning: Learning experiences are based on course content and activities that fully explain the concepts and procedures students are required to learn. Emphasis on instruction, active presentation of information, clear organization of presentation, step-by-step progression from topic to subtopic, effective media rich content, use of examples, visual prompts, demonstrations, constant assessment, modification of

instruction based on assessment, and effective use of time and student management. Students will gain sufficient knowledge and demonstrate foundational skills to support the other learning strategies.

- **Active Experimentation:** Learning experiences are based on case studies, real-world challenges, problem solving, and critical thinking. Students gain experience in recognizing and identifying problems, justifying the importance of the problems, and exploring possible solutions through application of technologies and concepts, in a cycle of experience, reflection, conceptualization, and action.
- **Discovery Learning:** Learning experiences will engage the student to develop theories about how the problem might be solved and discussions with experts in the field. Problems may or may not have solutions, but in collaboration with other students and experts develop ideas. A measure of student achievement is the ability to frame the problem, think logically through potential solution paths, and identify and use appropriate technologies, tools, and methods required by the proposed solutions.



Each of the four courses will use all learning strategies, with Active Experimentation and Discovery Learning occurring in the context of the Virtual Teaching Environment, where students engage in simulated or real-world problems and engage in extensive hands-on practical work.

### Work Area B: Technical Infrastructure for Directed, Problem-based, and Discovery Learning

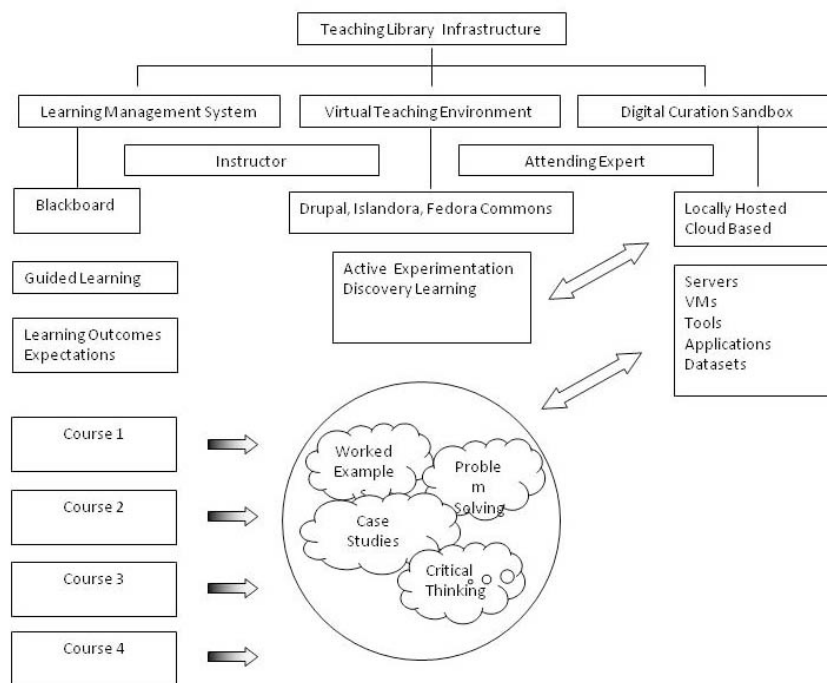
Encompasses all aspects of the design, development, implementation, testing, and demonstration of a teaching library infrastructure to support the three learning strategies and to provide intensive hands-on practical training. Development and prototyping will occur in collaboration with UNT Libraries. We propose three major components for this infrastructure.

- **Learning Management System (LMS):** Blackboard is UNT's enterprise LMS and will be used to support the students' Direct Guided Learning. All structured course content will be presented through the LMS. Instructors and students will use various Blackboard tools and features (e.g. synchronous discussions; asynchronous communication; assignment delivery; student submission of work products, etc.).
- **Virtual Teaching Environment (VTE):** A major innovation of this proposal is the development and testing of a VTE. This is modeled on work at the University of Prince Edward Island and its Virtual Research Environment, VRE (see for example, <http://loomware.typepad.com/docs/VRE.pdf> and [http://islandora.ca/virtual\\_research\\_environments](http://islandora.ca/virtual_research_environments)). The VTE (like the VRE) is based on an open-source software platform comprising Drupal (content management system), Fedora (digital repository), and Islandora (a Drupal module that combines Drupal and Fedora; see <http://islandora.ca/about>). The Drupal/Islandora/Fedora (DIF) platform is used in PI Moen's current IMLS-funded project (<http://www.apiaryproject.org/>) and UNT's Texas Center for Digital Knowledge has been exploring the use of DIF infrastructure for a variety of projects. The VTE is intended to signal a contextual and cognitive shift for students from Direct Guided Learning to Active Experimentation and Discovery Learning. Students will be presented with case studies, worked examples, and other problems, and the VTE will provide access to a suite of tools and applications students will learn and use in carrying out the learning activities. Collaboration tools will be available for students, faculty, and experts. What is exciting about the DIF platform is that students will be working in an environment that integrates a digital repository as part of the

infrastructure for their work. They will be actively managing and addressing digital curation and management issues with the inputs and products of their problem-solving and discovery learning activities.

- **Digital Curation and Data Management Sandbox:** The final component of the teaching library infrastructure is the computational resources, storage, tools, applications, and datasets that comprise a working digital curation and data management environment. Access to this infrastructure is via the VTE. It will serve as a sandbox for student hands-on engagement with technologies and tools. The sandbox will be initially offered by UNT Libraries using its existing Systems Infrastructure and Digital Library platform. After testing, assessment, and refinement of this sandbox infrastructure, we plan to port this to cloud computing services, thus giving students direct experience with the challenges and opportunities of cloud computing.

The graphic below depicts the proposed teaching library infrastructure. Additional information on the infrastructure is contained in *Supporting Documentation*.



### Work Area C: Recruitment

Addresses the recruitment of four groups of participants for this project: three target students groups, and one group of potential Teaching Library Liaisons from LIS Cohort Partner Libraries. Student recruitment will begin in Month 6 and continue through Month 29 when the courses are last offered as part of the project. Attention will be given to recruiting distributed students in cohorts located in Virginia, California, Georgia, Utah, and the Northern Rockies. The College of Information's External Affairs Office coordinates all recruitment efforts, and the project team will provide the Office with recruitment materials for the course offerings and the GAC. Since the GAC is intended to support development of a new cyberscholar workforce, we plan to connect with regional workforce development efforts as well

- **LIS Masters Information Science Majors:** In Spring 2010, the UNT LIS program began offering a GAC in Digital Content Management. The response has been very positive; more than 30 students have completed this generalist GAC in its first year. The proposed GAC in Digital Curation and Data Management will provide a more articulated career path for information professionals and address more focused knowledge, skills, and competencies combined with extensive practical training. We are setting a target of 20 LIS Masters Information Science majors to complete the Certificate by the end of the project.
- **Current Librarian Practitioners:** UNT GACs are available to Post-master professionals. We will actively recruit and target 10 current library practitioners to complete the GAC during the project.
- **Discipline-Specific Graduate Students:** An exciting aspect of this project is providing training to discipline-specific (non-LIS) students. Three UNT faculty members (Biology/Computer Science, History, and

Engineering) have committed to serving on the Project Advisory Group (see Management Plan); they have indicated the need for data management, digital curation, cyberinfrastructure, and cyberscholarship training for their students and research assistants. This proposal is, in part, a response to those needs. We are setting a target 15 discipline-specific graduate students to enroll in Course 1 (Cyberinfrastructure Fundamentals) during the project. Recruitment will be from existing UNT graduate students in disciplines including: Electrical Engineering, History, Biology, Environmental Science, Political Science, and Computer Science. Grant funds are requested to offset the cost of tuition for 15 students for one course.

- Teaching Library Liaisons at UNT LIS Cohort Partner Libraries: The UNT LIS distributed learning model is based on geographically located cohorts (e.g., in a state or region) with major partner academic libraries serving as a home for each cohort. An academic librarian from a partner library can be a valuable addition to the teaching library experience for the cohort student. These Teaching Library Liaisons will be involved in the learning experiences, providing examples and cases of local challenges in digital curation and data management, and providing datasets for students to engage with. We are targeting three partner libraries to provide a professional staff member to serve as a Liaison. Grant funds are requested to reimburse the partner libraries for the staff time of the Liaison's work in the teaching library. We already have commitment from the Dean of one Partner Library to serve on the Project Advisory Group.

#### Work Area D: Project Management and Dissemination

All aspects of the project will be actively managed (see Management Plan). Senior project personnel will be responsible for early and ongoing dissemination of information about the project (see Dissemination).

#### Evaluation Plan (Work Area E)

This work area addresses the various formative evaluation and assessments (e.g., of the courses, of the technical infrastructure for learning, etc.) and also an outcomes-based evaluation of the entire initiative.

- Assessment of Courses and Learning Experiences: We are committed to producing effective learning experiences and successful student learning achievement using clearly stated and measurable learning outcomes. Working with experts from UNT's Center for Learning Enhancement, Assessment, and Redesign, we will design appropriate assessments to measure student learning outcomes as we design the courses. We will assess and refine the four courses after each of their offerings in the spirit of continuous improvement. We will also develop assessment methods for other aspects of the courses including but not limited to: content, instructional method, teaching library experience, satisfaction, etc. The results of these assessments will guide course revision and enhancement.
- Outcomes-Based Evaluation: In Year 1 we will develop an outcomes-based evaluation plan focused on these preliminary anticipated project outcomes:
  - Increase students' preparedness (i.e., knowledge and skills) by enhancing the practical training and engagement with real-world digital curation and data management problems.
  - Positively change discipline-specific graduate students' knowledge and perception of the roles of academic libraries as collaborators with scientists and scholars in digital curation, data management, and cyberscholarship.
  - Positively affect distributed, online LIS education through the Virtual Teaching Environment infrastructure experience.
  - Improve LIS faculty and UNT librarian's abilities and attitudes for collaboration in LIS education to serve as a model for such collaboration.

Additional outcomes, audiences, targets, and indicators will be identified as we develop the evaluation plan. The evaluation plan will be implemented and refined during Years 2 and 3, with final project evaluation completed and reported by end of project.

#### **Project Resources: Budget, Personnel, and Management Plan**

##### Budget

We are requesting \$624,663 from IMLS to cover the costs (direct and indirect) for this capacity-building initiative. UNT is providing the required cost share of \$274,280 (50% of total, less funds for student support). This is in the form of faculty and staff time, support for one research assistant including tuition support, travel,



and other expenses. The *Budget Justification* details anticipated expenses. All appropriate institutional administrative procedures will be followed related to staffing, payment of salaries, travel, and other aspects of the project where expenses will be incurred. Funding from IMLS will be used primarily for:

- UNT graduate research assistants, including tuition stipends, supervised by Moen and Kim
- Partial salaries for several key personnel
- Stipends to recruit discipline-specific graduate students into courses
- Stipends to recruit Teaching Library Liaisons at UNT LIS Distributed Cohort partner libraries
- Travel to IMLS required meetings and professional and scholarly conferences.

### **Personnel**

Key personnel have appropriate expertise and experience including: digital preservation, repositories, instructional design, curriculum development, online instruction, digital libraries, creation and management of digital data and metadata resources, information technology, academic/research libraries, and other key areas to ensure project success.

William E. Moen, Martin Halbert, and Jeonghyun Kim serve as principal investigators (PIs) and comprise the project management team. Moen will be responsible for overall management of the project to ensure successful completion of project deliverables. He will be assisted by Halbert, who will oversee and coordinate the activities of UNT Libraries' staff in support of the Teaching Library Infrastructure, specifically the Digital Curation and Data Management Sandbox environment; he brings extensive experience with digital preservation to inform course content. Kim will lead and coordinate curriculum development and instructional design. Moen will also oversee the development and implementation of the Virtual Teaching Environment. Moen will devote approximately 13% of his faculty time during the 36-month project. Each year of the project, Halbert will commit approximately 5% of his time, and Kim will commit approximately 20% of her time. See *List of Key Project Staff* and *Resumes of Key Project Staff* for additional information on all project staff and *Budget Justification* for description of responsibilities of all project staff.

Moen (LIS Associate Professor and Director of the Texas Center for Digital Knowledge) has managed a number of large research and development projects, including two previous IMLS National Leadership Grants, and is currently PI on an IMLS National Leadership Grant. He recently completed a project funded by the Texas Higher Education Coordinating Board to design and develop a learning object repository. Halbert (Dean of UNT Libraries and LIS Associate Professor) has served as PI for grants and contracts totaling more than \$6M during the past six years, funding more than a dozen large scale collaborative projects. His research and projects have focused on exploring the future of research library services with special attention to strategies for sharing cyberinfrastructure between universities. Kim (LIS Assistant Professor) has departmental responsibilities for digital information curriculum development. Her research interests include digital libraries, human computer interaction, research methods and evaluation, and convergence issues related to libraries, archives and museums.

Four additional UNT staff will serve as key personnel. Mark Phillips (Assistant Dean of UNT Libraries for Digital Libraries) will commit 5% of his time for the project. He will advise on the Digital Curation and Data Management Sandbox and provide input into the curriculum and learning experiences. He will be supported two other UNT Librarians (TBD) who will commit 25% and 5% levels of effort respectively. Clifford Whitworth (College of Information Research Scientist) has extensive experience in instructional design, creating interactive multimedia modules, dynamic Internet solutions, and web-based community building. He will oversee instructional design for the courses, creation of learning materials, and the development of the Virtual Teaching Environment.

Four graduate research assistants (3 Ph.D. and 1 Masters) will be employed to participate in all aspects of the project. Each Ph.D. student will have a primary responsibility: Project Coordinator; Curriculum and Instructional Development; or Virtual Teaching Environment. The Masters student will have primary responsibility for the project's web presence and course support activities. The research assistants will develop new knowledge and

skills related to curriculum development and delivery, assessment and evaluation, information technology, and digital curation and data management.

### **Management Plan**

Moen will be responsible for the overall management of the project, including project planning, fiscal oversight, and all required reports. With support from the College of Information staff he will administer the project resources in compliance with University policies and procedures.

The Project Design and Evaluation Plan section presents the project's strategic work areas (see also *Schedule of Completion*). Upon award of the grant, the team will develop a detailed project management plan to guide all project activities and ensure successful and timely completion of the project activities. To provide external oversight of the project, we will establish a Project Advisory Group (AG) of 7-10 members, drawn from representatives of several stakeholder groups, including academic librarians, UNT LIS Distributed Cohort Partner Libraries, discipline-specific faculty members, and participants in national digital curation and data management initiatives (see *Supporting Documentation* for names and affiliations of initial members of the AG). The AG will review proposed course content and learning experience activities to ensure our objective of practical, real-world training is achieved and will disseminate information about this project.

### **Communication Plan**

UNT will not act in isolation from other important digital curation and data management initiatives and educational efforts already underway. These include the people and projects such as the international collaboration, Closing the Digital Curation Gap Project (funded by IMLS in 2009) and the Digital Curation Exchange (<http://digitalcurationexchange.org>) developed as part of the IMLS-funded DigCCurr initiative. Multi-faceted communication activities will include (and may be expanded during the project):

- Project website that provides access to all project documents and reports, course syllabi, sample course modules, sample student learning experiences, technical descriptions of the Virtual Teaching Environment and Digital Curation Sandbox, etc. Website will be maintained post-project for 3 years.
- A "Lessons Learned" blog that will actively disseminate information related to project activities, challenges, solutions, and student experiences. The blog will be RSS enabled to reach a broad audience.
- Presentations at conferences such as the Digital Curation Conference, the Association of Library and Information Science Education, iSchool Conference, Coalition for Networked Information, and others.
- Articles submitted to scholarly journals such as Journal of Education for Library and Information Science, College & Research Libraries, and professional journals such as American Libraries.
- Guest access to the Virtual Teaching Environment for demonstration of its functions, features, and uses.

We will develop online and hardcopy materials to recruit students (local and distributed) to the GAC. At UNT we will continue post-project to ensure that discipline-specific students are aware of our cyberinfrastructure and training.

### **Sustainability Plan**

Upon completion of the project, the courses and the GAC will be offered on a continuing basis to UNT Information Science majors, librarians, and discipline-specific students as a career path specialization. The new capacity in the LIS program built with IMLS funding will be sustained as these courses are integrated into our course inventory. The technology infrastructure components (i.e. VTE and Digital Curation Sandbox) are tightly integrated into the course design and pedagogy, and thus, they will be supported post-project by UNT. Students can be assessed appropriate course fees for technology that is integrated into courses. The fees will be used for maintaining the UNT Libraries and LIS infrastructure components used in the courses.

We are committed to making the course materials developed during the project widely available, and we will discuss arrangements with IMLS and UNT regarding IP and licensing to achieve this objective. Open Educational Resources and Creative Commons licensing provide models for sharing course materials. All technical specifications for the Virtual Teaching Environment and Digital Curation and Data Management Sandbox will be available, along with open source applications and tools, via the project website.

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