Toward a Computational Framework for Library and Archival Education:
Report on Preliminary Literature and Curriculum Review

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Report prepared by the
Computational Archival Science Research Group
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“Developing a Computational Framework for Library and Archival Education”
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1. Introduction

This report summarizes a literature review and curriculum review conducted in support of the “Developing a Computational Framework for Library and Archival Education” project of the Digital Curation Innovation Center (DCIC) at the iSchool at the University of Maryland, College Park. Funded by the Institute of Museum and Library Services, the project aims to develop building blocks for a Master’s-level curriculum to educate the next generation of librarians and archivists in the computational treatments of digital collections, starting with a workshop held in conjunction with iConference 2019 in College Park, Maryland.1

This literature review identifies a preliminary set of topics in the archival and LIS literatures that correspond to computational thinking practices. The goal of this report is to seed conversation in the upcoming workshop. The topics identified in this report may serve as a starting point for developing dedicated units or modules, with corresponding learning objectives, for a curriculum that foregrounds computational treatments of collections. We identified more than 50 aspects of library or archival education with a clear relationship to computational thinking practices; and we are sure there are many more.

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1 https://dcicblog.umd.edu/ComputationalFrameworkForArchivalEducation/2019/03/25/ct-las-education-imls-workshop-agenda/
Domains represented in this literature review include archives; archival education, professional identify, and career preparedness; digital archives; digital humanities and computational thinking; collections-as-data; and prior publications of the DCIC. We reviewed approximately 30 published sources in these domains to identify topics that relate to computational thinking practices. As we sought to identify relevant topics, we were guided by the taxonomy of computational thinking practices offered in Weintrop et al. (2016). This taxonomy is illustrated in Figure 1.

<table>
<thead>
<tr>
<th>Data practices</th>
<th>Modeling and simulation practices</th>
<th>Computational problem solving practices</th>
<th>Systems thinking practices</th>
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<td>Collecting data</td>
<td>Using computational models to understand a concept</td>
<td>Preparing problems for computational solutions</td>
<td>Investigating a complex system as a whole</td>
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<tr>
<td>Creating data</td>
<td>Using computational models to find and test solutions</td>
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<td>Understanding the relationships within a system</td>
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<td>Manipulating data</td>
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<td>Analyzing data</td>
<td>Designing computational models</td>
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<td>Visualizing data</td>
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<td>Creating computational abstractions</td>
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<td></td>
<td></td>
<td>Troubleshooting and debugging</td>
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</tbody>
</table>

*Figure 1. Weintrop et al. (2016) taxonomy of computational thinking practices*

Because the goal of this review is to enrich dialog in the upcoming workshop, this report should be considered preliminary. We do not aim to provide a comprehensive review of relevant educational initiatives, programs, or literatures. Instead, our purpose is to provide a set of topics derived from a shallow but wide-ranging review, to evince the broad range of computational topics already present in LIS and archival research and professional practice.

Finally, the report provides a brief summary of relevant courses from several academic programs in section 3. Many of the topics surfaced by this review are present in existing curricula. The goal of section 3 is to identify courses that are likely to be using computational methods, or that are likely to be amenable to the introduction of computational units. It is a starting point for ongoing research on existing computational thinking practices implemented in MLIS and archival education programs, which will aim to identify gaps or areas that are high priorities for curriculum development. Ongoing work is investigating how the topics identified in this report and topics identified in Weintrop’s (2016) framework of computational thinking practices are served by existing MLIS courses and programs. For more details on this work, see Underwood et al. (2018) and Marciano et al. (2018b).
2. **Mapping topics in the literature to SAA Curriculum**

This section gives the topics identified by the literature review. Each topic is an aspect of library or archival education with a clear relationship to computational thinking practices; therefore, each topic represents a potential unit of a computationally-oriented LIS/archival curriculum. More than 50 topics were identified in the course of this review. To organize the topics and help readers grasp the broad range of topics, this section maps them to the Society of American Archivists’ (SAA) Guidelines for a Graduate Program in Archival Studies (GPAS).²

The SAA GPAS curriculum has two components: core archival knowledge, providing the basis necessary for professional archival work, and complementary knowledge. Here we focus on the core archival knowledge branch.³ Core archival knowledge includes the following categories in the SAA GPAS:

(1) Knowledge of archival material and archival functions
   a. The nature of records and archives
   b. Selection, appraisal, and acquisition
   c. Arrangement and description
   d. Preservation
   e. Reference and access
   f. Outreach, instruction, and advocacy
   g. Management and administration
   h. Records and information management
   i. Digital materials management (records and access systems)

(2) Knowledge of the profession
   a. History of the archives and archives profession
   b. Records and cultural memory
   c. Ethics and values

(3) Contextual knowledge
   a. Social and cultural systems
   b. Legal and financial systems

As noted in the introduction, we identified relevant topics from the literature in light of a taxonomy of computational thinking practices (Weintrop et al., 2016). It is our understanding that most of the computational thinking practices in this taxonomy may be usefully applied to many different aspects of LIS and archival work, especially (but not exclusively) when that work involves data and digital collections. Prior research on a computational framework for LIS and archival education mapped specific activities performed as part of a digital curation project to this taxonomy, in order to demonstrate how the taxonomy can effectively guide thinking about computational practices in LIS and archives (Underwood et al., 2018; Marciano et al., 2018b).

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² [https://www2.archivists.org/prof-education/graduate/gpas/curriculum](https://www2.archivists.org/prof-education/graduate/gpas/curriculum)
³ Information technology is a specific point of focus in the “complementary knowledge” branch. However, we focus on relating information technologies and computational thinking and practices to the core knowledge units, because we see computational thinking and practice as imperative to the future of core aspects of LIS and archival work.
By way of illustration, we note several aspects of the SAA GPAS curriculum that align very closely with each category of computational thinking practice in the taxonomy (Figure 2), and we describe these alignments below.

- **Selection, appraisal, and acquisition** of digital archival collections requires computational thinking practices such as collecting and analyzing data from the “Data” category of the taxonomy. Reference, access, and the management and administration of large-scale digital collections rely on “Data” practices including manipulation and visualization.

- **Systems thinking practices** such as investigating complex systems as wholes, understanding the relationships within systems, and thinking in levels are imperative to teaching students about the nature of records and archives, and the infrastructures and systems that contextualize and support LIS and archival work.

- **Digital preservation and management** of digital archives rely on every computational problem-solving practice identified in the taxonomy, including assessing different approaches to problems, troubleshooting and debugging, and developing modular solutions.

- **Finally**, computational thinking practices that fall under “Modeling and simulation” in this taxonomy, such as designing and constructing computational models, have immediate relevance to the design of descriptive and database schemas, and therefore to the creation and organization of electronic records, and they fundamentally inform our understanding of what digital archives are, how they are constituted, and how they serve as evidence.

The remainder of this section provides the broad topics identified in the review, categorized or grouped in alignment with units in the SAA GPAS hierarchy. Table 1 adapts the SAA GPAS hierarchy to organize the topics identified in our quick-and-dirty review of the literature. The topics are given as bullet points in the column labeled, “Potential computational archival curriculum topics”. They are grouped into categories of the SAA curriculum. We acknowledge that the mapping of topics to categories is incomplete and debatable; most of the topics identified could easily fall into multiple categories of archival knowledge. Nonetheless, we hope that mapping topics
into the framework shows how computational topics from the archival and LIS literatures could readily fit into and round out an archival curriculum. The mapping is meant to be a conversation-starter, to help us get a handle on the massive bodies of existing knowledge and from them to generate building blocks for a curriculum.

Along with the topics, the table provides citations to the literature, intended to justify inclusion of each topic. These citations are meant to be examples, to indicate that each topic identified has at least one authoritative source in the archival literature. The cited sources are not necessarily the original, definitive, or otherwise “best” sources for each theme, and we acknowledge that there are many, many more sources that correspond to these topics. See the complete list of sources used under “References”, below.
Table 1. Mapping framework of topics to SAA knowledge units as foundation for ongoing conversation

<table>
<thead>
<tr>
<th>SAA Knowledge Unit</th>
<th>Potential computational archival curriculum topics</th>
<th>Example citations</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SAA Category: Knowledge of archival material and archival functions</strong></td>
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</tbody>
</table>
| The nature of records and archives | • Logical and physical organization of data  
• Impact of automation on recordkeeping practices  
• Implications of digitization for the representation of objects, people, phenomena, etc. (continuous vs. discrete; medial and epistemic changes; etc.)  
• Trust, authenticity, reliability, evidential value, and other foundational concepts as impacted by electronic records  
• Archival multiverse | Hedstrom, 1993; Berry, 2011; Yakel et al., 2013 |
| Selection, appraisal, and acquisition | • Creating, receiving, appraising, selecting, ingesting and accessioning data and digital records  
• Digitization and datafication as processes  
• Scope and completeness in datasets  
• Authenticity and digital records/data, including digital signatures, data integrity, hash codes, blockchain  
• Digital forensics techniques for appraisal and authentication | Hedstrom, 1993; Higgins, 2008; Francis, 2015; Jansen and Marciano, 2016; Marciano et al., 2018a; Gilliland 2014; Conway, 2015 |
| Arrangement and description | • Documentation for automated systems  
• Documenting integrity, form, and access  
• Persistently citable datasets  
• Challenges and strategies of documenting provenance of digitally processed records, including machine-readable provenance, multiple provenance, and workflows  
• Description and discovery for users of archival data and computationally amenable cultural collections  
• Computational finding aids | Hedstrom, 1993; Padilla, 2016; Jansen and Marciano, 2016; Esteva, 2017; Marciano et al., 2018a; Padilla et al., 2017 |
| Preservation | • Digital stewardship, preservation, curation  
• Preservation techniques (including emulation, migration), cost modeling, selection, staffing configurations, policymaking  
• Preservation metadata, trustworthy and trusted digital repositories  
• Cyberinfrastructure for digital archives and preservation  
• Integrity framework: content, fixity, reference, provenance, and linkages  
• Implications of preservation techniques for authenticity and reliability  
• Transfer methods with integrity verification and resume from failure | Gilliland 2014; Conway, 2015; Cloonan and Sanett, 2002; Yakel et al., 2013; Waters and Garrett, 1996; Conway, 2010; Gilliland-Swetland, 2000; Higgins, 2008 |
| Reference and access (and use) | • Reference for archival data and records  
• Digital information security, access, licensing  
• Identification of user communities and user requirements for electronic records/data  
• Use and reuse of records/data—implications, data curation for  
• Data sharing and reuse in archival settings across different communities (researchers, publics, etc.)—implications for evidence, privacy, etc.  
• Application of archives and archival frameworks, standards, and processes to grand challenges  
• Research methods for use of archives and archival data:  
  o Computational methods applied to qualitative archival research including historical, archival, case and field studies, action research, developmental, etc., and interpretive, experiential, emotive, generative research with specific attention to complexity, medium specificity, historical context, and critique;  
  o Quantitative archival research: correlational, quasi-experimental, and survey methods;  
  o Evaluating the outcomes of algorithmic methods, and the critique and critical application of algorithmic, machine-learning, and AI treatments to archival data and records;  
  o Advanced computational techniques for the administration, management, and use of archives and archival records and data: named entity indexing, random sample subsetting, querying and running scripts based on subsets, spatial and temporal analytics, graph analytics, computational linguistics for archival description and memory, and visualization | Duff and Yakel, 2017;  
Gilliland, 2016;  
Harris, 2018;  
Hedstrom, 1993;  
Higgins, 2008;  
Esteva et al. 2016;  
Faniel and Zimmerman, 2011;  
Gilliland, 2014;  
Gilliland, 2016;  
Conway, 2015;  
Jansen and Marciano, 2016;  
Leonard, 2014;  
Lemieux, 2014;  
Marciano, 2017 |
| Outreach, instruction, and advocacy | • Postcustodianship and implications for archival data and digital records  
• Cultural competencies and social justice considerations for archivists and computational archival work  
• Community archives, community records, digital public projects, exhibits, public humanities efforts and crowd-sourced projects, data and metadata  
• Public engagement with and use of digital archives and data  
• Understanding impact of digital records, data, and archives | Noonan et al., 2017;  
Jansen and Marciano, 2016;  
Marciano et al., 2018a |
| Management and administration / Records and information management / Digital materials management (records and access systems) | • Information systems components (hardware, data and data structures, software, storage media and methods, file transfer protocols, networks, etc.) and their implications for and application to archival records storage, transmission, etc.  
• Migration and manipulation techniques and considerations  
• Big data storage, cloud computing and archives, record processing, and transformation  
• Cyberinfrastructure and digital research infrastructure  
• Access systems: development, use, evaluation | Higgins, 2008; Marciano, 2016; Jansen and Marciano, 2016; Berry, 2011; Gold, 2007; Marciano et al., 2018a; Hedstrom, 1993; Gilliland, 2014; Conway, 2015; Berry, 2011;  

**SAA Category: Knowledge of the profession**

| History of the archives / Records and cultural memory / Ethics and values | • Cultural competencies and social justice considerations for archivists, and computational archival work  
• Cultural and community issues relating to memory, recordkeeping and digital archives, including communities of memory, communities of practice, and community archives  
• Ethical approaches to big data records, including privacy/PII  
• Relating archival and recordkeeping imperatives, frameworks, processes, technologies, and standards to interdisciplinary research  
• Implications for, and evolution and continuity of archival principles and practices in light of historical technological shifts  
• Personal archiving and implications for archives as data  
• Social media archives and implications for archives as data  
• Open access considerations, strategies, and tools, in conversation and contrast with privacy, security, and community-specific concerns | Noonan et al., 2017; Gilliland, 2016; boyd, Keller, and Tijierina, 2016  

**SAA Category: Contextual knowledge**

| Social and cultural systems; Legal and financial systems | • Sociotechnical systems for integration of distributed archives, records, and recordkeeping systems  
• Postcustodianship, cocreatorship, archivalization and implications for archival data and records  
• Communities of memory, community archives, and archival data/computational approaches  
• Legal and policy issues related to data, technology  
• Commodification of archives and data  
• Development, assessment, accountability of scalable and sustainable service infrastructures for big data archives and supporting computational approaches | Gilliland 2016; Gilliland 2014; Conway, 2015; Padilla, 2018; Hedstrom, 1993; Cox and Larsen 2009 |
- Digital repatriation and virtual reunification
- Social media archives
- Relationships of archives to digital scholarship and research across disciplines and communities
- Application of archives and archival frameworks, standards, and processes to grand challenges
3. Mapping existing courses to the curation lifecycle

This section provides a brief summary of relevant courses from several academic programs. The goal of this section is to identify courses that are likely to be using computational methods, or that are likely to be amenable to the introduction of computational units. To this end, we gathered course lists from eight U.S. schools with strengths in archives and digital curation:

- Society of American Archivists Digital Archives Specialist Curriculum and Certificate Program
- Simmons University School of Library and Information Science
- University of California, Los Angeles GSEIS Department of Information Studies
- University of Illinois at Urbana-Champaign School of Information Sciences at the
- University of Maryland, College Park College of Information Studies
- University of Michigan School of Information
- University of North Carolina at Chapel Hill School of Information and Library Science
- University of Texas at Austin School of Information

From the course lists we selected recent courses pertaining to archives and digital curation. This is an informal sample of relevant programs and courses. It is by no means comprehensive and is intended only as a starting point to help us understand the existing curricular landscape. It lays groundwork for a future detailed survey of existing computational methods and practices being taught in LIS programs, which would target a much larger sample of iSchools both in the U.S. and internationally, and which would review syllabuses where available.

In this section we simply list the relevant courses identified in this review, associating them with phases of the digital curation lifecycle (Higgins, 2008) just to help readers get a handle on the range of courses out there in light of a widely accepted model of digital curation work. The appendix gives a complete list of courses by institution.
Figure 3. Selected courses on formative processes of digital collections

Courses specific to...

Formative processes of digital collections:
Creation, reception, appraisal, selection, ingestion, accession...

Michigan S1632 Appraisal of Archives
Michigan S175 Digitization Cultural Heritage Materials
SAA DAS Accessioning and Ingest of Electronic Records
SAA DAS Appraisal of Electronic Records
UMD LBSC 785: Documentation, Collection and Appraisal of Records
UT-Austin INF 385R Survey of Digitization.
UCLA 430. Library Collection Development
Courses specific to...

**Arrangement, description, metadata:**

- Illinois IS 562 Metadata in Theory & Practice, credit: 4 Hours.
- SAA DAS Arrangement and Description of Electronic Records I
- SAA DAS Arrangement and Description of Electronic Records II
- SAA DAS Beginner’s guide to metadata
- SAA DAS Electronic Records—The Next Step!
- Simmons LIS 445 Metadata
- UMD LBSC 782: Arrangement, Description and Access for Archives
- UNC-Chapel Hill INLS 720. Metadata Architectures and Applications. 3 Credits.
- UNC-Chapel Hill INLS 721. Cataloging Theory and Practice. 3 Credits.
- UNC-Chapel Hill INLS 722. Introduction to Metadata Architectures and Applications. 1.5 Credit.
- UNC-Chapel Hill INLS 757. Principles and Practices in Archival Description. 3 Credits.
- UT-Austin INF 384M. Topics in Description and Metadata.
- UT-Austin INF 384W. Descriptive Cataloging and Metadata.
- UCLA 260. Description and Access
- UCLA 269. Seminar: Information Structures
- UCLA 270. Systems and Infrastructures
- UCLA 461. Descriptive Cataloging
- UCLA 462. Subject Cataloging and Classification
- UCLA 463. Indexing and Thesaurus Construction
- UCLA 464. Metadata

Figure 4. Selected courses on arrangement, description, and metadata
Figure 5. Selected courses on access, use, and reuse

Courses specific to...

Access, use, and reuse:

- Illinois IS 545 Social Justice in the Information Professions credit: 2 Hours.
- Illinois IS 581 Administration and Use of Archival Materials credit: 4 Hours.
- Illinois IS 590 Memory Media, Memory Institutions
- SAA DAS Building advocacy and support for digital archives
- SAA DAS Copyright issues for digital archives
- SAA DAS Privacy and confidentiality in digital archives
- SAA DAS Providing access to digital archives
- UMD INFM 605: Users and Use Context
- UMD INFM 722: Copyright, Privacy, and Security in Digital Information
- UMD LBSC 708W: Exhibitions, Public Programs, and Outreach in Libraries, Archives and Museums
- UMD LBSC 723: Advocacy and Support for Information Services
- UCLA 205. Cyberspace Law and Policy
- UCLA 434. Archival Use and Users
Courses specific to...

- Data science, analytics, mining, and visualization:
  - Illinois IS 590DSH Data Science in the Humanities
  - Illinois IS 590DST Data Science Storytelling
  - Illinois IS 590DT Data Mining
  - Illinois IS 590DV Data Visualization
  - Illinois IS 590MD Methods for Data Science
  - Illinois IS 590MSC Advanced Topics in Machine Learning & Social Computing
  - Illinois IS 590TX Text Mining
  - Simmons LIS 473 Information Visualization
  - UNC-Chapel Hill INLS 512. Applications of Natural Language Processing. 3 Credits.
  - UNC-Chapel Hill INLS 541. Information Visualization. 3 Credits.
  - UNC-Chapel Hill INLS 613. Text Mining. 3 Credits.
  - UNC-Chapel Hill INLS 625. Information Analytics. 3 Credits.
  - UNC-Chapel Hill INLS 641. Visual Analytics. 3 Credits.
  - UNC-Chapel Hill INLS 712. Introduction to Text Mining. 1.5 Credit.
  - UNC-Chapel Hill INLS 714. Introduction to Information Analytics. 1.5 Credit.
  - UCLA 278. Information and Visualization

Figure 6. Selected courses on data science, analytics, mining, and visualization
Figure 7. Selected courses on preservation and sustainability

Courses specific to...

Preservation and sustainability:

- Illinois IS 586: Digital Preservation credit: 4 Hours.
- Michigan SI625: Digital Preservation
- Michigan SI678: Preserving Sound and Motion
- SAA DAS: Achieving email account preservation with XML
- SAA DAS: Digital curation planning and sustainability
- SAA DAS: Digital forensics: Advanced
- SAA DAS: Digital Forensics: Fundamentals
- SAA DAS: Preservation formats in the context of PDF
- SAA DAS: Preserving digital archives
- Simmons LIS 444: Archiving and Preserving Digital Media
- Simmons LIS 448: Digital Stewardship
- UMD INST 784: Digital Preservation
- UMD LBSC 786: Library and Archives Preservation
- UNC-Chapel Hill INLS 561: Digital Forensics for Curation of Digital Collections. 3 Credits.
- UNC-Chapel Hill INLS 752: Digital Preservation and Access. 3 Credits.
- UNC-Chapel Hill INLS 766: Audit and Certification of Trustworthy Digital Repositories. 1.5 Credit.
- UNC-Chapel Hill INLS 767: Information Assurance. 3 Credits.
- UT-Austin INF 392H: Creating Sustainable Digital Collections.
- UCLA 241: Digital Preservation
- UCLA 432: Issues and Problems in Preservation of Heritage Materials
- UCLA 480: Introduction to Media Archiving and Preservation
Courses specific to...

Management processes and practices:

- SAA DAS Basics of Managing Electronic Records
- SAA DAS Developing specifications and RFPs
- SAA DAS Managing electronic records
- Simmons LIS 477 Digital Asset Management for Libraries, Archives, and Museums
- UMD INFM 612: Management of Information Programs and Services
- UMD INST 615: Legal Issues in Managing Information
- UMD INST 646: Principles of Record & Information Management
- UMD INST 647: Management of Electronic Records & Information
- UMD LBSC 646: Principles of Record & Information Management
- UNC-Chapel Hill INLS 465. Understanding Information Technology for Managing Digital Collections. 3 Credits.
- UNC-Chapel Hill INLS 525. Electronic Records Management. 3 Credits.
- UNC-Chapel Hill INLS 624. Policy-Based Data Management. 3 Credits.
- UNC-Chapel Hill INLS 749. Art and Visual Information Management. 3 Credits.
- UNC-Chapel Hill INLS 756. Data Curation and Management. 3 Credits.
- UNC-Chapel Hill INLS 758. International and Cross-Cultural Perspectives for Information Management. 3 Credits.
- UNC-Chapel Hill INLS 765. Information Technology Foundations for Managing Digital Collections. 1.5 Credit.
- UT-Austin IMS 387. Identity Information Management and Repositories.
- UCLA 233. Records and Information Resources Management
- UCLA 240. Management of Digital Records

Figure 8. Selected courses on management processes and practices
Figure 9. Selected courses on systems, infrastructure, architecture, and tools.

- **Systems, infrastructure, architecture, tools:**

  - Illinois IS 532  Theory & Practice of Data Cleaning  credit: 4 Hours.
  - Illinois IS 542  Data, Statistical Models and Information  credit: 4 Hours.
  - Illinois IS 590OD  Ontology Development
  - Illinois IS 590OM  Open Data Mashups
  - Illinois IS 590PR  Programming for Analytics and Data Processing
  - Michigan S1629  Access Systems
  - SAA DAS  Archival collections management systems
  - SAA DAS  Digital repositories
  - SAA DAS  User experience design
  - Simmons LIS 458  Database Management
  - Simmons LIS 469  XML-eXtensible Markup Language
  - Simmons LIS 485  Introduction to Programming
  - Simmons LIS 467  Web development and information architecture
  - UMD INST 734:  Information retrieval systems
  - UNC-Chapel Hill INLS 523  Introduction to Database Concepts and Applications. 3 Credits.
  - UNC-Chapel Hill INLS 560  Programming for Information Science. 3 Credits.
  - UNC-Chapel Hill INLS 576  Distributed Systems and Administration. 3 Credits.
  - UNC-Chapel Hill INLS 578  Protocols and Network Management. 3 Credits.
  - UNC-Chapel Hill INLS 582  Systems Analysis. 3 Credits.
  - UNC-Chapel Hill INLS 623  Database Systems II: Intermediate Databases. 3 Credits.
  - UNC-Chapel Hill INLS 723  Database Systems III: Advanced Databases. 3 Credits.
  - UT-Austin INF 380P  Introduction to Programming.
  - UT-Austin INF 384R  Digital Repositories.
  - UT-Austin INF 385M  Database Management.
  - UT-Austin INF 385E  Information architecture and design.
  - UT-Austin INF 384H  Concepts of information retrieval.
  - UCLA 274  Database Management Systems
  - UCLA 276  Information Retrieval Systems: Structures and Algorithms
  - UCLA 277  Information Retrieval Systems: User-Centered Designs
  - UCLA 279  User Experience Design
Figure 10. Selected comprehensive and foundational courses

Comprehensive, survey, and foundational courses:

- Illinois IS 531 Foundations of Data Curation credit: 4 Hours.
- Illinois IS 543 Sociotechnical Information Systems credit: 4 Hours.
- Illinois IS 560 Digital Libraries credit: 4 Hours.
- Illinois IS 561 Information Modeling credit: 4 Hours.
- Illinois IS 590CA Community Archives: Documenting Heritage and Identity
- Illinois IS 590DH Digital Humanities
- Michigan S1580 Understanding Records and Archives: Principles and Practices
- Michigan S1639 Web Archiving
- Michigan S1640 Digital Libraries and Archives
- Michigan S1667 Foundations of Digital Curation
- SAA DAS Digital archives and libraries
- SAA DAS Digital Curation: Fundamentals for Success
- SAA DAS Standards for Digital Archives
- SAA DAS Thinking Digital: Practical Session to Help You Get Started
- SAA DAS Web archiving fundamentals
- Simmons LIS 454 Digital Information Services and Providers
- Simmons LIS 472 Moving Image Archives
- Simmons LIS 488 Technology for Information Professionals
- Simmons LIS 462 Digital Libraries
- UMD INST 643: Curation in Cultural Institutions
- UNC-Chapel Hill INLS 520. Organization of Information. 3 Credits.
- UNC-Chapel Hill INLS 540. Building a Personal Digital Library. 3 Credits.
- UNC-Chapel Hill INLS 626. Introduction to Big Data and NoSQL. 1.5 Credits.
- UNC-Chapel Hill INLS 728. Seminar in Knowledge Organization. 3 Credits.
- UNC-Chapel Hill INLS 740. Digital Libraries: Principles and Applications. 3 Credits.
- UNC-Chapel Hill INLS 750. Introduction to Digital Curation. 3 Credits.
- UT-Austin INF 380E. Perspectives on Information.
- UT-Austin INF 382U. Digital Resources for Children and Youth Seminar.
- UT-Austin INF 383H. Introduction to Digital Humanities.
- UT-Austin INF 385S. Digital Libraries.
- UT-Austin INF 389G. Introduction to Electronic and Digital Records.
- UCLA 211. Artifacts and Cultures
- UCLA 236. Approaches to Materialities of Texts and Media
- UCLA 262B. Data Curation and Policy
- UCLA 431. Archives, Records, and Memory
- UCLA 433. Community-Based Archiving
- UCLA 447. Computer-Based Information Resources (Online Searching)
- UCLA 473. Information Technology and Libraries
4. Next steps

This report is intended to provoke and enrich conversation at the upcoming workshop on a Framework for Introducing Computational Thinking into Library and Archival Science Education. Further research on various aspects of this review will be essential to guiding ongoing collaboration on a computational framework in pursuit of objectives identified at the workshop. The literature review should be expanded to encompass a larger and more systematic sample of the archival and LIS literature. The framework will benefit from a broader and deeper survey of existing, relevant instructional materials. To this end, the course lists provided in section 3 will serve as a starting point for identifying a set of syllabuses for collection and analysis. Finally, this report lays the groundwork for a post-workshop complete report on our ongoing conversation and research on developing a computational framework for library and archival education.

5. References


http://www.clir.org/pubs/reports/pub89/contents.html


Appendix: Selected relevant curricula and courses

Digital Archives Specialist Curriculum and Certificate Program (SAA)

Core competencies:

1. Understand the nature of records in electronic form, including the functions of various storage media, the nature of system dependence, and the effect on integrity of records over time.
2. Communicate and define requirements, roles, and responsibilities related to digital archives to a variety of partners and audiences.
3. Formulate strategies and tactics for appraising, describing, managing, organizing, and preserving digital archives.
4. Integrate technologies, tools, software, and media within existing functions for appraising, capturing, preserving, and providing access to digital collections.
5. Plan for the integration of new tools or successive generations of emerging technologies, software, and media.
6. Curate, store, and retrieve original masters and access copies of digital archives.
7. Provide dependable organization and service to designated communities across networks.

Course list:

- Basics of Managing Electronic Records
- Thinking Digital: Practical Session to Help You Get Started
- Standards for Digital Archives
- Beginner’s guide to metadata
- Appraisal of Electronic Records
- Digital Curation: Fundamentals for Success
- Arrangement and Description of Electronic Records I
- Digital Forensics: Fundamentals
- Electronic Records—The Next Step!
- Accessioning and Ingest of Electronic Records
- Arrangement and Description of Electronic Records II
- Digital repositories
- Preserving digital archives
- Copyright issues for digital archives
- Developing specifications and RFPs
- Digital archives and libraries
- Providing access to digital archives
- Building advocacy and support for digital archives
- Privacy and confidentiality in digital archives
- Archival collections management systems
- Web archiving fundamentals
• Achieving email account preservation with XML
• Preservation formats in the context of PDF
• Digital forensics: Advanced
• User experience design
• Managing electronic records
• Digital curation planning and sustainability

University of Maryland, College Park iSchool

*From Underwood et al. (2018)*

• INST 646: Principles of Record & Information Management
• LBSC 785: Documentation, Collection and Appraisal of Records
• LBSC 782: Arrangement, Description and Access for Archives
• LBSC 786: Library and Archives Preservation
• INST 784: Digital Preservation
• Reference and Access
• Users and Use Context
• Information Retrieval Systems
• LBSC 708W: Exhibitions, Public Programs, and Outreach in Libraries, Archives and Museums
• LBSC 723: Advocacy and Support for Information Services
• INFM 612: Management of Information Programs and Services
• LBSC 646: Principles of Record & Information Management
• INST 647: Management of Electronic Records & Information
• INST 784: Digital Preservation
• LBSC 708P: Preserving Memory: Archives and Archivists in America
• LBSC 708P: Preserving Memory: Archives and Archivists in America
• INFM 612: Management of Information Programs and Services
• INST 643: Curation in Cultural Institutions
• INST 615: Legal Issues in Managing Information
• INFM 722: Copyright, Privacy, and Security in Digital Information
Simmons University iSchool

Program Links
- Spring 2019 Course Catalog/L (Library and Information Science (LIS): http://courses.simmons.edu/spring/l

- LIS 444 Archiving and Preserving Digital Media
- LIS 445 Metadata
- LIS 448 Digital Stewardship
- LIS 458 Database Management
- LIS 467 Web Development and Information Architecture
- LIS 469 XML-eXtensible Markup Language
- LIS 500 Independent Study

- LIS 454 Digital Information Services and Providers
- LIS 462 Digital Libraries
- LIS 472 Moving Image Archives
- LIS 473 Information Visualization
- LIS 477 Digital Asset Management for Libraries, Archives, and Museums
- LIS 485 Introduction to Programming
- LIS 488 Technology for Information Professionals
- LIS 503 Practicum for Cultural Heritage Informatics
University of Illinois iSchool

- IS 490 Advanced Topics in Information Studies credit: 2 to 4 Hours.
- IS 531 Foundations of Data Curation credit: 4 Hours.
- IS 532 Theory & Practice of Data Cleaning credit: 4 Hours.
- IS 542 Data, Statistical Models and Information credit: 4 Hours.
- IS 543 Sociotechnical Information Systems credit: 4 Hours.
- IS 545 Social Justice in the Information Professions credit: 2 Hours.
- IS 560 Digital Libraries credit: 4 Hours.
- IS 561 Information Modeling credit: 4 Hours.
- IS 562 Metadata in Theory & Practice credit: 4 Hours.
- IS 581 Administration and Use of Archival Materials credit: 4 Hours.
- IS 586 Digital Preservation credit: 4 Hours.
- IS 590CA Community Archives: Documenting Heritage and Identity
- IS 590DH Digital Humanities
- IS 590DSH Data Science in the Humanities
- IS 590DST Data Science Storytelling
- IS 590DT Data Mining
- IS 590DV Data Visualization
- IS 590MD Methods for Data Science
- IS 590MMM Memory Media, Memory Institutions
- IS 590MSC Advanced Topics in Machine Learning & Social Computing
- IS 590OD Ontology Development
- IS 590OM Open Data Mashups
- IS 590PR Programming for Analytics and Data Processing
- IS 590TX Text Mining

University of Michigan iSchool

- SI625 Digital Preservation https://www.si.umich.edu/programs/courses/625
- SI629 Access Systems https://www.si.umich.edu/programs/courses/629
- SI632 Appraisal of Archives https://www.si.umich.edu/programs/courses/632
• SI639 Web Archiving [https://www.si.umich.edu/programs/courses/639](https://www.si.umich.edu/programs/courses/639)
• SI640 Digital Libraries and Archives [https://www.si.umich.edu/programs/courses/640](https://www.si.umich.edu/programs/courses/640)
• SI667 Foundations of Digital Curation [https://www.si.umich.edu/programs/courses/667](https://www.si.umich.edu/programs/courses/667)
• SI75 Digitization Cultural Heritage Materials [https://www.si.umich.edu/programs/courses/675](https://www.si.umich.edu/programs/courses/675)
• SI678 Preserving Sound and Motion [https://www.si.umich.edu/programs/courses/678](https://www.si.umich.edu/programs/courses/678)

University of North Carolina–Chapel Hill iSchool

• INLS 465. Understanding Information Technology for Managing Digital Collections. 3 Credits. [https://ils.unc.edu/courses/2018_spring/inls465_001/inls465-001.html](https://ils.unc.edu/courses/2018_spring/inls465_001/inls465-001.html)
• INLS 512. Applications of Natural Language Processing. 3 Credits. [https://ils.unc.edu/courses/2017_spring/inls512_001/inls512-001.pdf](https://ils.unc.edu/courses/2017_spring/inls512_001/inls512-001.pdf)
• INLS 520. Organization of Information. 3 Credits. [https://ils.unc.edu/courses/2018_spring/inls520_001/](https://ils.unc.edu/courses/2018_spring/inls520_001/)
• INLS 523. Introduction to Database Concepts and Applications. 3 Credits. [https://ils.unc.edu/courses/2016_fall/inls523_003/INLS523-003.pdf](https://ils.unc.edu/courses/2016_fall/inls523_003/INLS523-003.pdf)
• INLS 525. Electronic Records Management. 3 Credits. [https://ils.unc.edu/courses/2018_spring/inls525_001/inls525-001.pdf](https://ils.unc.edu/courses/2018_spring/inls525_001/inls525-001.pdf)
• INLS 540. Building a Personal Digital Library. 3 Credits. [https://ils.unc.edu/courses/2015_spring/inls540_001/540-LifeTime-Library-Syllabus.pdf](https://ils.unc.edu/courses/2015_spring/inls540_001/540-LifeTime-Library-Syllabus.pdf)
• INLS 541. Information Visualization. 3 Credits. [https://ils.unc.edu/courses/2018_spring/inls541_001/](https://ils.unc.edu/courses/2018_spring/inls541_001/)
• INLS 560. Programming for Information Science. 3 Credits. [https://ils.unc.edu/courses/2015_spring/inls560_002/](https://ils.unc.edu/courses/2015_spring/inls560_002/)
• INLS 561. Digital Forensics for Curation of Digital Collections. 3 Credits. [https://ils.unc.edu/courses/2017_spring/inls561_001/](https://ils.unc.edu/courses/2017_spring/inls561_001/)
• INLS 576. Distributed Systems and Administration. 3 Credits.
• INLS 578. Protocols and Network Management. 3 Credits.
• INLS 582. Systems Analysis. 3 Credits. [https://ils.unc.edu/courses/2018_spring/inls582_001/home.html](https://ils.unc.edu/courses/2018_spring/inls582_001/home.html)
• INLS 613. Text Mining. 3 Credits. [https://ils.unc.edu/courses/2014_fall/inls613-001/](https://ils.unc.edu/courses/2014_fall/inls613-001/)
• INLS 624. Policy-Based Data Management. 3 Credits. [https://ils.unc.edu/courses/2018_spring/inls624_01W/inls624-01W.pdf](https://ils.unc.edu/courses/2018_spring/inls624_01W/inls624-01W.pdf)
• INLS 625. Information Analytics. 3 Credits. [https://ils.unc.edu/courses/2017_fall/inls625_002/inls625-002.docx](https://ils.unc.edu/courses/2017_fall/inls625_002/inls625-002.docx)
• INLS 626. Introduction to Big Data and NoSQL. 1.5 Credit. [https://ils.unc.edu/courses/2016_spring/inls626_001/Syllabus-626-001-Fall2016.pdf](https://ils.unc.edu/courses/2016_spring/inls626_001/Syllabus-626-001-Fall2016.pdf)
• INLS 641. Visual Analytics. 3 Credits. [https://ils.unc.edu/courses/2017_fall/inls641_001/](https://ils.unc.edu/courses/2017_fall/inls641_001/)
• INLS 712. Introduction to Text Mining. 1.5 Credit.
• INLS 714. Introduction to Information Analytics. 1.5 Credit.
• INLS 720. Metadata Architectures and Applications. 3 Credits. [https://ils.unc.edu/courses/2016_summerII/inls720_001/INLS%20720%20Syllabus.pdf](https://ils.unc.edu/courses/2016_summerII/inls720_001/INLS%20720%20Syllabus.pdf)
• INLS 721. Cataloging Theory and Practice. 3 Credits.
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<td>Database Systems III: Advanced Databases</td>
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<td>Seminar in Knowledge Organization</td>
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<td>INLS 740</td>
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<td>INLS 749</td>
<td>Art and Visual Information Management</td>
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<td>INLS 750</td>
<td>Introduction to Digital Curation</td>
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<td>INLS 752</td>
<td>Digital Preservation and Access</td>
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<td>Data Curation and Management</td>
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<td>Principles and Practices in Archival Description</td>
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<td>INLS 758</td>
<td>International and Cross-Cultural Perspectives for Information Management</td>
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<td>INLS 765</td>
<td>Information Technology Foundations for Managing Digital Collections</td>
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<td>Audit and Certification of Trustworthy Digital Repositories</td>
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<td>INLS 794</td>
<td>Digital Curation Internship</td>
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**University of Texas at Austin iSchool**

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<td>IMS 387</td>
<td>Identity Information Management and Repositories</td>
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<td>INF 382P</td>
<td>Competitive Intelligence Resources and Strategies</td>
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<td>INF 383D</td>
<td>Mathematical Foundations of Information Studies</td>
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<td>INF 384W</td>
<td>Descriptive Cataloging and Metadata</td>
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<td>INF 384H</td>
<td>Introduction to Digital Humanities</td>
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<td>INF 385E</td>
<td>Information Architecture and Design</td>
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<td>Topics in Description and Metadata</td>
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<td>Digital Repositories</td>
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<td>INF 385R</td>
<td>Survey of Digitization</td>
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<td>Digital Libraries</td>
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<td>INF 389K</td>
<td>Life Cycle Metadata for Digital Objects</td>
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- **INF 380E.** Perspectives on Information. [https://www.ischool.utexas.edu/courses/class_details?ClassID=2666](https://www.ischool.utexas.edu/courses/class_details?ClassID=2666)
- **INF 380P.** Introduction to Programming. [https://www.ischool.utexas.edu/courses/course_details?CourseID=362](https://www.ischool.utexas.edu/courses/course_details?CourseID=362)
- **INF 382U.** Digital Resources for Children and Youth Seminar. [https://www.ischool.utexas.edu/courses/course_details?CourseID=327](https://www.ischool.utexas.edu/courses/course_details?CourseID=327)
- **INF 392H.** Creating Sustainable Digital Collections. [https://www.ischool.utexas.edu/courses/course_details?CourseID=321](https://www.ischool.utexas.edu/courses/course_details?CourseID=321)
- **INF 389G.** Digital Archiving and Preservation. [https://www.ischool.utexas.edu/courses/course_details?CourseID=233](https://www.ischool.utexas.edu/courses/course_details?CourseID=233)

**UCLA**

- 205. Cyberspace Law and Policy
- 211. Artifacts and Cultures
- 233. Records and Information Resources Management
- 236. Approaches to Materialities of Texts and Media
- 240. Management of Digital Records
- 241. Digital Preservation
- 260. Description and Access
- 262B. Data Curation and Policy
- 269. Seminar: Information Structures
- 270. Systems and Infrastructures
- 274. Database Management Systems
- 278. Information and Visualization
- 279. User Experience Design
- 430. Library Collection Development
- 431. Archives, Records, and Memory
- 432. Issues and Problems in Preservation of Heritage Materials
- 433. Community-Based Archiving
- 434. Archival Use and Users
- 447. Computer-Based Information Resources (Online Searching)
- 461. Descriptive Cataloging
- 462. Subject Cataloging and Classification
• 463. Indexing and Thesaurus Construction
• 464. Metadata
• 473. Information Technology and Libraries
• 480. Introduction to Media Archiving and Preservation