The Knowledge Organization Education Within and Beyond the Master of Library and Information Science

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Abstract: By analyzing 63 English-speaking institutions that offer ALA-accredited master's programs in library and information studies, this research aims to explore the education for knowledge organization (KO) at different levels and across fields. This research examines the KO courses that are the required courses and elective courses in the MLIS programs, that are offered in other master's programs and graduate certificate programs, that are adapted to the undergraduate degree and certificate programs, and that are particularly developed for programs other than MLIS. The findings indicate that the great majority of MLIS programs still have a focus on or a significant component of knowledge organization as their required course and include the knowledge organization elective courses, particularly library cataloging and classification, on their curriculum. However, there is a variety of the offerings of KO related courses across the programs in an institution or in the same program across the institutions. It shows a promising trend that the traditional and new KO courses play an important role in many other programs, at different levels and across fields. With the conventional, adapted, or innovative content, these courses demonstrate that the principles and skills of knowledge organization are applicable to a wide variety of settings, can be integrated with other disciplinary knowledge and emerging technologies, and meet the needs of different career pathways and groups of learners.

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1. Introduction

Knowledge organization (KO), is the fundamental in the field of library and information science (LIS). Many MLIS (Master of Library and Information Science) curricula include the courses that cover the principles and practices of knowledge organization, from the traditional cataloging and classification to more contemporary areas such as taxonomies, ontologies, metadata, and linked data. In recent years, library and information schools have broadened their scope and boundaries to include a more multidisciplinary and technology-driven approach. Many programs, concentrations, or areas of emphasis have been developed or re-developed with the increasing integration of technologies and the growth of interdisciplinary perspectives, such as digital asset management, data analytics, health informatics. There is a high demand for professionals to work with different types of information, knowledge, and data in various settings, and the emerging technologies in the organization and retrieval of information. KO education which originated from MLIS has undergone observed changes to keep up with the current trends. It would be valuable to understand how KO education adapt and expand to meet the needs at different levels and across fields in a changing information landscape.

2. A Literature Review

As shown in Table 1, these previous studies were almost all focused on the ALA-accredited MLIS programs and the results were obtained from the programs' websites, with two specifically from the course readings and course syllabi.

Knowledge organization remained very visible in most programs and traditional bibliographic content remained at the core of knowledge organization courses (Miller et al. 2006; Pattuelli 2010; Salaba 2020; Dobreski et al. 2021; Hu-

don 2021). The majority of the programs (94%) had a requirement for a course that covered topics in knowledge organization, about half of the programs offered a set of courses as a cluster of courses, pathway, specialization, or concentration in knowledge organization (Salaba 2020). The KO-related courses could be categorized into the courses dedicated specifically to KO topics and general OI, the courses whose content required application of KO concepts, and the courses which included KO as one unit or part a topic (Miller et al. 2006). The most common were the dedicated IO courses, and the combined IO/IR courses or reference courses appeared as more common sources of IR coverage than the dedicated IR courses (Dobreski et al. 2021). However, an analysis of selected schools in Southeast Asia, Europe and accredited schools of North America (Rehman and Alajmi 2017) found only 21 LIS schools listed core courses in KO, and elective coursework was diverse in scope, titles and policies of the schools offering them.

The current trends in curricula are aligned with the findings of prior research. KO seemed to be growing in popularity for areas outside of cataloging, such as digital libraries, special librarianship, and knowledge management (Miller et al. 2006). Metadata became a central component of course content, and topics like information architecture, markup languages, and semantic web became part of education, indicating the methods and techniques aimed at electronic resources and applicable to different types of information systems and environments (Pattuelli 2010). Taxonomies, folksonomies, and ontologies are indispensable KO tools in the changed contexts of expanding knowledge, interdisciplinarity, and changing role of organizations (Rehman and Alajmi, 2017).

It was noted that not all programs offered courses beyond the required course, which means students might have a limited exposure to KO (Pattuelli 2010). The similar tendencies were recorded (Hudon 2021): the recent elimination of the required KO course in several programs, one third of KO electives listed in course catalogs not being scheduled in the past three years, and two thirds of those teaching KO specialized in other areas of information science.

3. Methods

Through examining the websites of 63 English-speaking institutions as listed on the directory (2023) that offer ALA-accredited Master's Programs in Library and Information Studies, this research intends to investigate the education for knowledge organization at different levels and across fields. This means focusing on the specific sections of the websites such as course descriptions, syllabi, course catalogs, program requirements, and other relevant information. This could provide valuable insight into how knowledge organization related courses are taught and applied in different settings and identify any gaps or opportunities for improvement in KO education.

ALISE (Association for Library and Information Science Education) Research Taxonomy defines the field of Information organization and retrieval as "processes and systems to effectively represent and organize, and retrieve information" and lists the following areas in KO: Abstracting, Classification, Cataloging, Indexing, Linked data, Metadata, Taxonomies, Ontologies, Semantic Web, Social tagging (2016). These were considered as the scope of courses to examine in this study, though the component of information organization may also be included, to some extent, in some other courses such as interactive information retrieval, digital libraries, bibliography, information architecture, etc.

This research addresses the following topics:

a) the required courses and elective courses in the MLIS programs that cover the general concepts of knowledge organization and the specific subfields within knowledge organization;

Previous studies	Research scope	Data source
Miller et al. (2006)	54 ALA-accredited programs	course catalog descriptions on websites
Pattuelli (2010)	57 ALA-accredited programs	course readings of introductory-level KO courses
Rehman and Alajmi (2017)	LIS programs of 68 schools in Southeast Asia, Europe and accredited schools of North America	course titles and descriptions on websites
Salaba (2020)	64 ALA-accredited programs	course titles and descriptions on websites
Dobreski et al. (2021)	41 ALA-accredited programs	IO/IR course syllabi
Hudon (2021)	65 ALA-accredited programs	programs' websites and other relevant sites

Table 1: Comparison of research scope and data source

b) the KO courses that are offered in other master's programs, such as the information management program, the data science program, etc., and how the KO courses fit into these newly developed programs;
c) the KO courses that are offered in the school library or teacher librarian program/certificate and other graduate certificates, and how the KO courses are applied to these certificate programs;
d) the KO courses that are offered in the new undergraduate programs and certificates, and how the KO courses are adapted to the undergraduate level education;
e) the evolvement of knowledge organization courses for the use of taxonomies, ontologies, metadata, linked data;
f) any other knowledge organization related courses that are particularly developed for programs (i.e., health informatics) other than MLIS.

The researcher conducted several rounds of LIS school website examinations to ensure the accuracy and currency of the collected data. The researcher also searched other websites, such as Coursicle, to look for and verify the relevant information, especially course descriptions. The collected data was tabulated into a spreadsheet for analysis.

4. Results and Discussions

4.1 KO Education Within MLIS

4.1.1 Required Courses

More than 80% of MLIS programs have a required course focusing on or primarily covering knowledge organization as it is a fundamental component of the library and information science field. Some required courses integrate information organization and information retrieval or other relevant content, from information preservation to user design, while a few required courses are more specific on cataloging, classification, and metadata. Most of the required courses are titled *Information Organization* or *Organization of Information*. It is worth noting that a few institutions have retired their KO required course and replaced it with a more general one that addresses the nature and roles of information through various perspectives, though such a course may still touch on the importance of information organization and retrieval. This could be a reflection of changing priorities within the field of library and information science, as well as the need for MLIS graduates to have a holistic understanding of the information environment beyond knowledge organization.

The required courses of MLIS programs aim to provide students with a strong foundation in the principles and practices of library and information science. The findings show that knowledge organization is still an important aspect of this, to prepare future information professionals to understand how information is structured and accessed, which will prove beneficial no matter which career pathway they follow (see Figure 1).

4.1.2 Elective Courses

More than 90% of the library and information schools provide at least one elective course in the knowledge organization areas. There are as most as eight KO elective courses that are delivered by a single school.

Library cataloging and classification is almost an indispensable elective course in the MLIS programs and constitutes the largest proportion of the KO courses. Two thirds

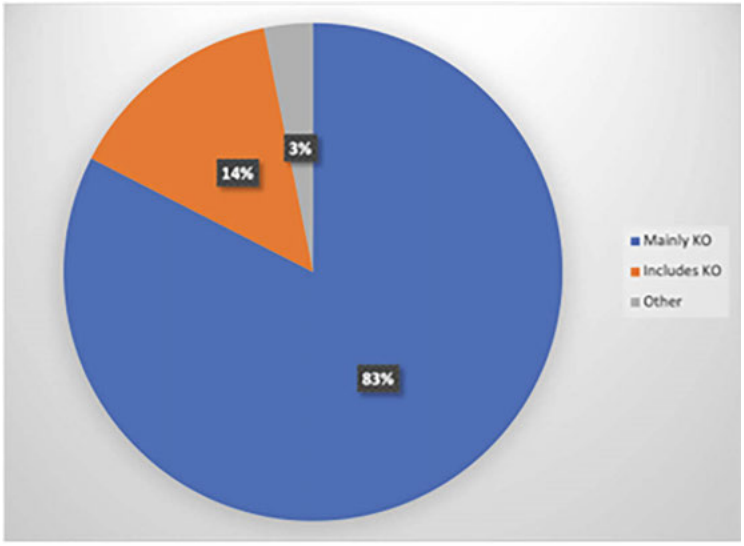

Figure 1. MLIS required courses

of the programs offer the cataloging and classification or descriptive cataloging courses, about one third offer the advanced cataloging courses, and one fifth offer the subject cataloging courses. The introductory cataloging courses, usually titled cataloging and classification, typically cover the cataloging standards and rules, such as RDA, LCSH, LCC, and DDC, and encoding bibliographic records in MARC 21 format under authority control. However, some programs also provide a separate subject cataloging course to specifically address classification schemes and subject headings used in the libraries.

Some programs deliver the advanced cataloging courses that focus on specialized formats or types of materials. While the principles of cataloging remain the same, there are specialized standards and rules required for cataloging certain types of materials, such as rare books, audiovisual materials, or cultural objects. These specialized cataloging may be standalone courses or be integrated into a broader cataloging course. There are also cataloging courses geared towards school libraries with collections for specific age groups or supporting the school curriculum. These courses provide in-depth training in specialized areas and unique challenges that are associated with different types of materials or audiences.

There are more metadata courses than the introductory cataloging courses in the MLIS programs, as more than two thirds of the programs offer the metadata courses and four programs even offer an advanced metadata course, for example, a 1 unit introductory metadata course and a 2 unit metadata applications course; or a metadata course and another course addressing advanced topics; or a metadata course and an additional metadata course in the interactive media domains. Topics covered in metadata courses include the general and domain-specific metadata schemas, for various formats and platforms, and approaches to metadata creation, storage, management, and dissemination. Metadata finds a much wider applicability since organizing and managing digital resources is essential for professionals working from libraries, archives, and museums to digital repositories and data management systems.

Though only a small number of elective courses are specifically in KOS (taxonomies, thesauri, ontologies), the indexing and abstracting courses usually include thesaurus construction as part of their content (a course containing equally indexing and thesaurus construction are counted separately in the chart). Indexing and abstracting, taxonomies, thesauri, and ontologies are not only valuable in traditional library settings, but can open up a wider range of career options for MLIS graduates beyond library settings dealing with catalog records. These skills are in high demand in many fields and industries such as special purpose collections, intranets, and e-commerce that require effective information management and content discovery strategies and can lead to fulfilling and rewarding careers outside of traditional library settings.

As an approach to publishing and connecting data on the web, linked data enables data to be shared, reused, and integrated across resources and has a significant impact on the libraries, archives, and museums. Despite fewer linked data courses as standalone courses (11%), most metadata courses and some traditional cataloging courses have begun to incorporate the emerging approaches to resource description and access via linked data. This reflects the growing recognition of the importance of linked data in the cultural heritage institutions and the need to train the information professionals for the knowledge and use of linked data standards and technologies.

A few programs that didn't have KO as a required course include a general knowledge organization course as an elective course. For courses on advanced topics of knowledge organization, they were not included in the analysis if no topics were specified in the course description (see Figure 2).

4.2 KO Education Beyond MLIS

It is a promising trend to see the traditional and new knowledge organization courses being offered in many programs other than MLIS, at different levels and across fields. The offerings of such KO related courses vary with the programs and institutions. This suggests a growing awareness of the value of KO in various fields and levels of education, reflecting its relevance and applicability in diverse contexts.

4.2.1 Other Master's Programs

The other master's programs where KO courses are also offered can be identified as twelve different groups of programs, as shown in Figure 3. Six different KO courses (information organization, cataloging, metadata, indexing, KOS, linked data) are offered in these twelve groups of master's programs other than MLIS. Though KO courses are found in a variety of master's programs, the course offering is limited in each program, with metadata courses as the most common, especially in the Information management and the Data science programs.

The importance of organization of information cannot be overstated in today's information-driven society. With the vast amount of data and information available, it has be come increasingly important to organize, store, retrieve and analyze information effectively and efficiently. The organization of information is a crucial skill that is essential for various information-related professions, such as librarians, information managers, data scientists, and information technology specialists. Therefore, it is not surprising that the course on information organization is also offered in many other master's programs, such as Information science, Information technology, Information management, Health informatics, Data science, Applied data science, and Infor-

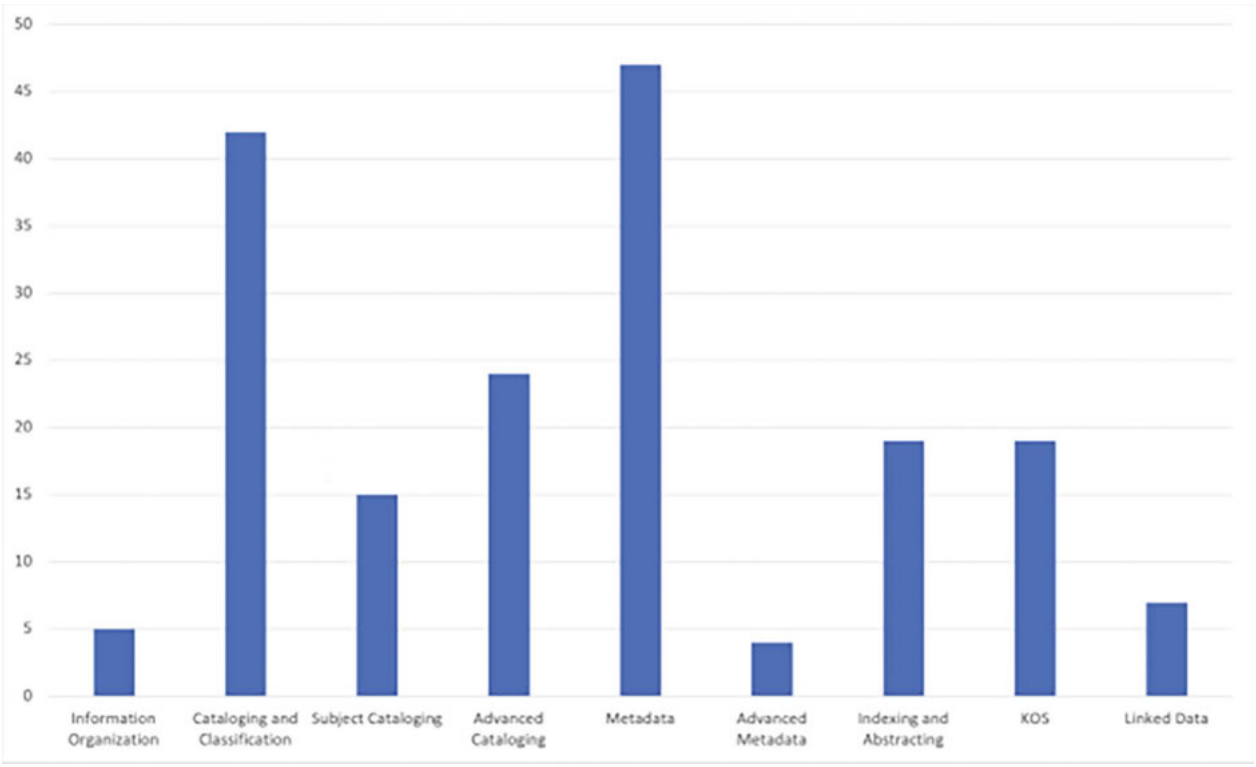

Figure 2. MLIS KO electives

mation security and cyber leadership. In addition to MLIS programs, this course is also a required course for Information science and Information management programs in some institutions.

Metadata is the most popular course as offered in nine of the twelve other master's programs listed above, even as a required course for the Digital curation and management program. Metadata has a natural relationship with the collections in archives and museums. For Data science as well as Bioinformatics programs, the understanding of the structure and content of the data can help data scientists describe and manage large datasets and conduct more efficient analysis. As a critical component of many different fields and disciplines, the importance of metadata lies in its ability to make data more discoverable, accessible, and useful, enabling information professionals and researchers to make better decisions and draw more accurate conclusions from their data. Metadata is a popular course in a range of master's programs, as it is essential knowledge for many different careers in the digital age.

While cataloging is only offered in the Museums and digital culture program, as a required course, and linked data is only an elective course in the same program, it is somewhat unexpected that indexing is an elective course in the Data science program, since cataloging, indexing, and linked data are thought to be more closely associated with the fields of libraries, archives, and museums. Most courses offered in other master's programs are from the existing course catalogs in the MLIS programs, so that explains since linked data is a comparatively new course and is even offered in fewer MLIS programs. Similarly, as an elective course and a required course for the User experience program and the Information management program respectively, KOS demonstrates how its potential can transcend conventional boundaries, allowing for versatile applications across diverse industries and contexts.

4.2.2 Graduate Certificate Programs

In addition to the master's degree programs, many institutions that offer ALA-accredited MLIS programs also offer graduate certificate programs in various specializations (see Figure 4).

The graduate certificate programs are grouped into the 9 clusters, with their certificate program titles as follows:

Cluster 1: archival studies, archives, archives and cultural heritage resources and services, archives and records management, archives & special collections, archives management, archives studies, cultural heritage information management, digital archives and records management, digital archives management, special collections librarian

Cluster 2: conservation and digital curation, data curation, digital curation

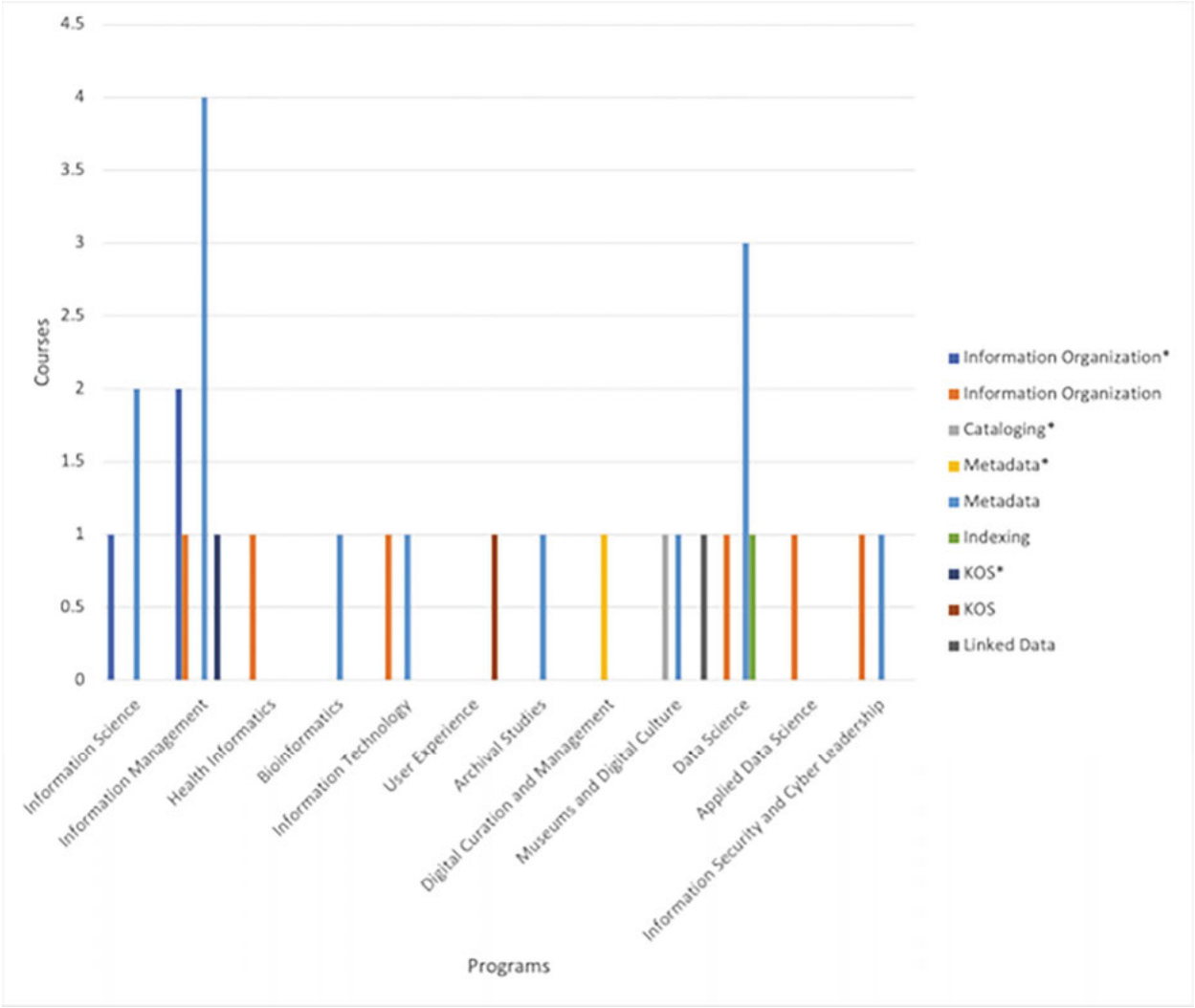

Figure 3. KO courses in other master's programs * represents required courses

Cluster 3: digital asset management, digital assets, digital content management, digital librarianship, digital libraries, digital services and emerging technologies
Cluster 4: digital humanities
Cluster 5: information architecture, web programming and information architecture
Cluster 6: children's and young adult library and community services, school library, school librarian, school librarianship, school library media, school library teacher, school media, teacher librarian, teacher librarian services
Cluster 7: data and knowledge management, information & knowledge management, information management, research data management
Cluster 8: bioinformatics, health informatics
Cluster 9: data science

Some certificate programs with same or similar names are combined in the same cluster, except digital curation since its course offerings are different from other certificates in archives and records management. KO-related courses are finding their way into these certificate programs that cater to different information professions and industries. Depending on the specific program and context, it can be an elective or a required course, highlighting the different levels of importance and focus placed on KO skills in each program. For example, in the Digital humanities, Information architecture, Information management certificates, information organization is listed as an elective course; in the Archives and records management certificates, it is a required course; and in the School library and Health informatics certificates, it is both a required and an elective course, depending on the institutions offering the program.

Metadata is a fundamental component of many information management and digital content-related fields. Therefore, it is often included as an elective course in all certificate programs listed above, with particular importance to

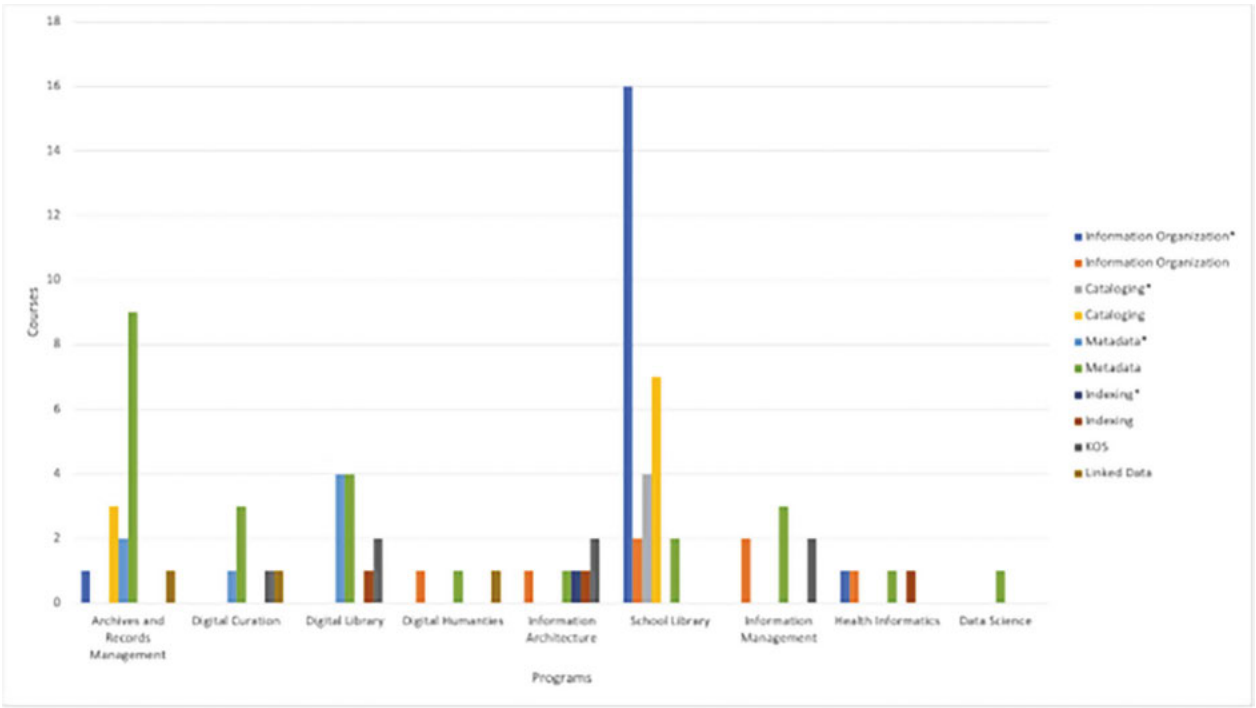

Figure 4. KO courses in graduate certificate programs * represents required courses

Archives and records management, Digital curation, and Digital library. On the other hand, cataloging is only offered as an elective course in the Archives and records management, and both a required and elective course in the School library certificate program. As discussed previously, school library certificate or endorsement is usually part of MLIS program so information organization is also its required course in most cases but cataloging plays an extremely important role to teacher librarians than any other certificate programs.

Indexing is a required and an elective course in the Information architecture certificate program, as well as an elective course in the Digital library and Health informatics. KOS is an elective course offered in four certificate programs: "ontologies" in the Information architecture certificate, "taxonomies" in the Digital library, Information architecture, and Information management certificates, "thesaurus construction" in the Digital curation, Digital library, and Information architecture certificates. Linked data is found as an elective course in several certificate programs: Archives and records management, Digital curation, and Digital Humanities. It is worth mentioning that these courses are not widely offered even in the MLIS programs, which underscores the need for ongoing professional development and staying current with emerging trends in the field. However, offering them as electives in certificate programs can provide interested students with an opportunity to explore these topics in more depth and gain expertise in specific areas of library and information science.

4.2.3 Undergraduate's Programs

Some library and information schools developed the undergraduate programs that are more practical and relevant to the needs of today's job market. Unlike the other master's programs and graduate certificate programs, there are four different KO courses for the undergraduate level education, with the absence of KOS and linked data.

Courses titled Information organization, Organization of information, Data organization and representation, Information indexing and organization, Knowledge organization for information science & technology are being included in these programs, such as bachelor degree in Information science, Information science and technology, Library and information science, Technology and information design, Data science/analytics, Applied data and information science/Data science, or relevant undergraduate certificate programs, as a required or an elective course. These courses typically have a core of information organization but are designed to be more applicable to undergraduate students. They may also be tailored to specific areas of interest or career paths, such as technology and information design. The inclusion of these courses in undergraduate programs reflects the growing importance of information organization and management in a wide range of fields and industries, and the need for professionals who can effectively navigate and utilize this information.

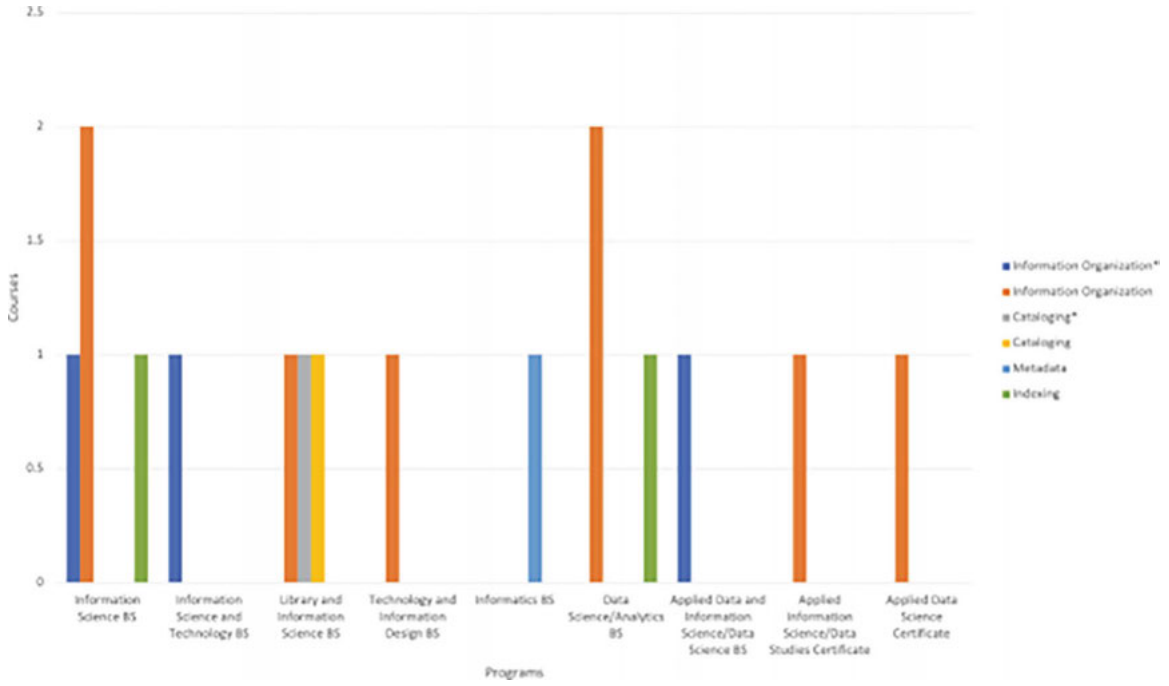

Figure 5. KO courses in undergraduate programs * represents required courses

Their course descriptions include the following keywords: representation, organization, documentation, description, classification, storage, access, retrieval, reuse, sharing, but some also mention "the methods and strategies to develop systems for storage, organization, and retrieval of information in a variety of organizational and institutional settings, as well as policy, ethical, and social implications of these systems" (University of Maryland), "the ideas, advantages, and challenges of information organization and creating and ensuring access to information in the 21st century" (The University of North Carolina at Greensboro).

It would be intriguing to explore the extent to which the KO content can reach in the undergraduate education. By examining a course syllabus in depth, we can observe its alignment with the overall scope of the undergraduate program. For the required course *Data organization and representation* in the undergraduate program, the student learning outcomes intend to "understand the basic principles and functions of representational structures such as taxonomy, ontology, thesauri, metadata, and folksonomy" but also "understand and effectively apply principles of representation and systems of organization to provide access to resources in a variety of information environments." Its seven student learning outcomes match with the following Applied Data and Information Science Program Learning Outcomes (Indiana University Purdue University Indianapolis):

Data literacy: Distinguish between data, information, and knowledge; Analyze the value and key role data plays in society in providing opportunities to expand knowledge, to innovate, and to influence; Assess values with respect to the use of data technologies.

Information science: Demonstrate an understanding of the data lifecycle, including data curation, stewardship, and long-term preservation; Apply the principles of consistency and uniformity to recognize the need for authorized terms for describing various types of data; Understand the principles of data organization including file name conventions, version control, and data documentation.

Other topics: Design, conduct, and write up results of research; Understand tools and techniques of project management.

The above highlights the importance of understanding how data and information is organized and represented, especially given the increasing value of data and information in changing environments. By understanding the key approaches and structures to organize and represent information, students can improve their ability in data management, storage, retrieval, and analysis. Effective organization and representation of data ensure data quality, consistency, and reliability, and help to enable efficient and accurate data analysis, decision-making, and communication. Incorporating data organization and representation into undergraduate programs is essential for students looking to work in data-related fields, such as data analysis, data management, or data science. Understanding these topics will help students develop the skills necessary to work effectively with data and help organizations leverage the value of their data assets.

4.2.4 Specific KO Courses

Almost all courses in the graduate certificate programs are taken from the MLIS programs of that institution, and although the courses in the undergraduate programs are not the same, they might have been replicated and adapted from the MLIS programs. Nevertheless, some original and innovative courses that are related to knowledge organization are found in other master's programs (such as digital health and information management), or even in the MLIS programs.

As the course description of *Knowledge Representation and Management in Health*,

> "This course provides an intensive introduction to methods and topics for knowledge representation and management, with an emphasis on symbolic methods and the social context of knowledge use in learning health systems. Students who complete the course will become familiar with important knowledge engineering technologies and standards. They will also have mastered foundational methods necessary for more advanced study and mentored research in collaborative knowledge representation and management." (University of Michigan)

and *Medical Knowledge Representation*,

> "Issues related to medical knowledge representation and its application in healthcare processes. Topics include data structures used for representing knowledge (conceptual graphs, frame-based models), different data models for representing spatio-temporal information, rule-based implementations, current statistical methods for discovery of knowledge (data mining, statistical classifiers, and hierarchical classification), and basic information retrieval. Review of work in constructing ontologies, with focus on problems in implementation and definition. Common medical ontologies, coding schemes, and standardized indices/terminologies (SNOMED, UMLS)." (UCLA).

The courses described above, *Knowledge Representation and Management in Health* and *Medical Knowledge Representation*, both emphasize the importance of knowledge representation and management in health informatics. In the context of health informatics, information organization involves the use of structured and standardized methods to represent medical knowledge and data. These methods include the systematic and structured arrangement of healthcare information using standardized terminologies, ontologies, and other knowledge representation frameworks. For example, the Unified Medical Language System (UMLS) is a comprehensive ontology-based knowledge representation system that integrates various biomedical vocabularies, classifications, and coding systems to support effective information organization in healthcare. SNOMED CT (Systematized Nomenclature of Medicine--Clinical Terms) is another widely used standardized medical terminology and coding system that enables consistent and interoperable representation of clinical data across different healthcare settings. These standardized methods ensure that medical information is consistent, accurate, and easily retrievable across different healthcare systems and organizations. In addition to standardization of medical terminology, knowledge representation and management may also apply to the electronic health records, clinical decision support systems, etc. It supports the effective management and use of medical knowledge and data and ensures that medical information is accurate, consistent, and accessible, which can lead to improved patient care and medical research.

To gain a more comprehensive understanding, it would be beneficial to compare two courses that are at an equivalent level but from two different programs: *INFO 5515 Organization of Information* from Master of Information program and *MGMT 5002 Organization of Information* from Master of Information Management program. Both mention organization, retrieval, and use, but MGMT 5002 has a focus on knowledge management and emphasizes the metadata and vocabulary control, from the LIS territory, "Information management is the management of organizational processes and systems that acquire, create, organize, distribute, and use information. This course examines the various means by which information can be organized to facilitate its retrieval, management and use, and provides an overview of the principles and theories of metadata development and implementation in the digital environment. Emphasis will be placed on metadata interoperability, vocabulary control, standardization, quality control and evaluation. Contextually-relevant information is essential to support decision making and strategic planning by individuals, groups and organizations." (Dalhousie University)

One specific KO course noteworthy is *Indigenous Systems of Knowledge*, "Conceptual foundations and comparative analysis of indigenous knowledge organization systems. Feasibility and use of contemporary knowledge organization mechanisms including thesauri and ontologies in expressing the cultures and artifacts of indigenous peoples." (University of Washington) Given the rich and diverse knowledge systems of indigenous communities around the world, it is crucial to acknowledge and respect their unique ways of organizing and expressing knowledge. This can help to bridge the gap between traditional indigenous knowledge and contemporary knowledge organization mechanisms, and also preserve and promote indigenous cultures and identities.

4.3 KO Competencies

American Library Association (ALA)'s 2021 draft of "Core Competency of Librarianship" states the competencies related to organization of recorded knowledge and information:

> 5A. Understand the principles, systems, trends, and goals involved in the organization and representation of recorded knowledge and information.
> 5B. Implement the developmental, descriptive, analytical, and evaluative skills needed to organize recorded knowledge and information.
> 5C. Maintain the systems of cataloging, collection, metadata, indexing, and classification standards and structures, and implement methods used to apply, create, and discover recorded knowledge and information, and the weaknesses and strengths of these systems.
> 5D. Recognize the ways that cultural biases impact and influence the collection and description of recorded knowledge and information.

A number of competency frameworks have been developed for information professionals by multiple information agencies. A few regarding organization of recorded knowledge and information are listed below:

- Canadian Association of Research Libraries (CARL) "Competencies for Librarians in Canadian Research Libraries" (2020): Knowledge of data services (data manipulation and curation, creation of standardized metadata ...; Understanding best practices, standards and protocols of digital curation, including the selection, collection, preservation, description, organization and archiving principles for digital documentation and research data in various formats; Understanding how information is organized for easy identification and retrieval, including cataloguing and metadata standards for all formats
- Medical Library Association (MLA) "Competencies for Lifelong Learning and Professional Success" (2017): Organizes resources according to national and international standards (basic), Develops classification and metadata schemes for unique collections (expert)
- NASIG "NASIG Core Competencies for Scholarly Communication Librarians" (2020): Knowledge of and ability to apply metadata schemata; Possess a basic knowledge of relevant metadata schemata; Data description and storage
- Chartered Institute of Library and Information Professionals (CILIP) "The Professional Knowledge and Skills Base" (2021): Organising all types of information and other resources including the development and use of tools, strategies and protocols, and enabling these resources to be organised, searched and retrieved effectively. Includes Metadata, Classification schemes and taxonomies, Ontologies, Thesauri and controlled vocabularies, Subject indexing, Cataloguing and resource description.

The above competencies are listed under the category of curation and preservation, information management, data management services, or institutional repository management services in the statements, which show which broader contexts knowledge organization may fit in. These competencies cover description, organization, metadata, cataloging, and classification. However, ALA's "Core Competency of Librarianship" is based on the recorded knowledge and information, and in their statements of competencies, the professional associations except CILIP neglected to mention taxonomies, ontologies, linked data as the current trends in knowledge organization. As a supplement to ALA's "Core Competency of Librarianship", ALCTS' "Core Competencies for Cataloging and Metadata Professional Librarians" (2017) identifies the following knowledge of trends in cataloging and metadata professions: the use of metadata to support reference, the impact of metadata on user access, linked data, PCC, LC-PCC Policy Statements, RDA Steering Committee, etc. This reflects the importance of staying informed about evolving practices and standards in cataloging and metadata professions to effectively serve library users and manage resources. However, it is worth noting that the field of library and information science is continuously evolving, and new trends and developments may have emerged beyond the last update.

In reflection on the competencies as stated in the above professional associations, the researcher also examined the core competencies (program learning outcomes) of one institution, San José State University. In regard to KO education, there are the required course in the MLIS program, and eight elective courses that cover cataloging and classification, metadata, indexing and abstracting, taxonomies, thesauri, ontologies, and advanced topics such as linked data, subject cataloging, cataloging of non-monograph or non-print materials. Out of 15 core competencies listed for the MLIS program, these courses map onto one to four competencies as follows:

> E Design, query, and evaluate information retrieval systems.
> F Use the basic concepts and principles related to the selection, evaluation, organization, and preservation of physical and digital information items.
> G Demonstrate understanding of basic principles and standards involved in organizing information such as classification and controlled vocabulary systems, catalog-

ing systems, metadata schemas or other systems for making information accessible to a particular clientele.

H Demonstrate proficiency in identifying, using, and evaluating current and emerging information and communication technologies.

All above stated courses support Competency G, half of the courses support Competency E, three of them support Competency F, and two of them support Competency H. This shows that cataloging and classification, controlled vocabularies, metadata schemas still remain to be the core concepts, information organization is integrated with information retrieval and the design and evaluation of information retrieval systems, the organization of information is closely related to the selection, evaluation, and preservation of information in its life cycle, and the emerging information and communication technologies play an increasingly important role in the organization of information.

Recently, the call for papers of the Eighteenth International ISKO Conference (2023) lists a range of topics. These topics are related to the times of crisis to deal with; the emerging technologies, such as artificial intelligence, machine learning, big data, "KO challenges and opportunities in the AI era, KO contributions to enhance machine learning and, conversely, machine learning for KO development, KO for dealing with big data;" the multidisciplinary knowledge from humanities, social sciences to sciences; the diverse information environments within and beyond cultural heritage institutions; the sociocultural issues and ethics; the development and maintenance, particularly linked data related, "improving the organization and usability of linked data, the application of FAIR principles, internal and external knowledge representation (including knowledge graphs and visualization), manual and automatic metadata creation, abstracting, and indexing." These topics reflect the ideas and thoughts to ponder on, and the research outcomes are expected to inform the future updates of competencies in KO.

5. Conclusion

The findings are based on the information available on the websites of 63 library and information schools with ALA-accredited MLIS programs, from the course descriptions, syllabi, course catalogs, program requirements, etc. The researcher also examined the member schools listed under iSchools Organization with a MLIS equivalent program, particularly the English-speaking institutions in Europe and Australia. Though fewer KO courses are offered, they also appear to follow a similar pattern.

The previous studies as reviewed are limited to the KO courses in the ALA-accredited MLIS programs. This research updates our knowledge through a comprehensive survey of KO courses from the library and information schools that offer ALA-accredited MLIS programs, and furthermore, the findings are more inspiring as shown from other master's programs, graduate certificate programs, and undergraduate degree and certificate programs of those schools, particularly the courses that contain the essential elements of knowledge organization but are applied to the various information environments. The organization of data and information has been the foundation in library and information science, but is transforming with the advancements of technologies and multidisciplinary knowledge and is finding its applicability to a wide variety of settings. This research will deepen our understanding of the KO education and inform the future directions of KO education.

References

American Library Association. 2023. *Directory of Institutions Offering ALA-Accredited Master's Programs in Library and Information Studies*. https://www.ala.org/CFApps/lisdir/directory_pdf.cfm

American Library Association. 2021. *ALA's Core Competences of Librarianship.* https://www.ala.org/educationcareers/sites/ala.org.educationcareers/files/content/education/Draft%20-%20ALA%20Core%20Competences%202021%20Update.pdf

Association for Library and Information Science Education. 2016. *ALISE Research Taxonomy.* https://www.alise.org/research-taxonomy-

Association for Library Collections & Technical Services. 2017. *Core Competencies for Cataloging and Metadata Professional Librarians.* https://alair.ala.org/handle/11213/7853

Canadian Association of Research Libraries. 2020. *Competencies for Librarians in Canadian Research Libraries*. https://www.carl-abrc.ca/wp-content/uploads/2020/09/Competencies-Final-EN-1-2.pdf

Chartered Institute of Library and Information Professionals. 2021. *The Professional Knowledge and Skills Base*. https://cdn.ymaws.com/www.cilip.org.uk/resource/resmgr/cilip/membership/benefits/pksb/pksb_intro_overview_v5.pdf

Dalhousie University. 2023. *MGMT 5002 Organization of Information*. https://www.dal.ca/faculty/management/school-of-information-management.html

Dobreski, B., Xiaohua Zhu, Tao Yang and Laura Ridenour. 2021. "Information Organization and Information Retrieval in the LIS Curriculum". *Proceedings of the Association for Information Science and Technology*, *58*(1), 707–709. https://doi.org/10.1002/pra2.536

Hudon, M. 2021. "The Status of Knowledge Organization in Library and Information Science Master's Programs". *Cataloging & Classification Quarterly*, *59*(6): 576–596.https://doi.org/10.1080/01639374.2021.1934766

Indiana University Purdue University Indianapolis. 2023. *LIS-S 202 Data Organization and Representation.* https://luddy.iupui.edu/syllabi/LIS-S202-Erpelding.pdf?04152023

International Society for Knowledge Organization. 2023. *Call for papers Eighteenth International ISKO Conference*. https://www.isko.org/isko2024cfp

Medical Library Association. 2017. *Competencies for Lifelong Learning and Professional Success*. https://www.mlanet.org/page/test-competencies

Miller, S.J., Melodie J Fox, Lee, Hur-Li Lee, and Holpe A. Olson. 2006. "Great Expectations: Professionals' Perceptions and Knowledge Organization Curricula". *Knowledge Organization for a Global Learning Society: Proceedings of the Ninth International ISKO Conference* 4-7 July 2006 Viena Austria edited by Gerhard Budin, Christian Swertz and Konstantin Mitgutsch. Advances in Knowledge Organization Baden-Baden: Ergon Verlag.

NASIG. (2020). *NASIG Core Competencies for Scholarly Communication Librarians*. https://www.nasig.org/Competencies-Scholarly-Communication

Pattuelli, M. C. 2010. "Knowledge Organization Landscape: A content Analysis Of Introductory Courses". *Journal of Information Science*, *36*(6): 812-822. https://doi.org/10.1177/0165551510388118

Rehman, S. and Bidi Alajmi. 2017. "Knowledge Organization Content in Graduate Coursework". *Library Review*, *66*(1/2): 90-106.https://doi.org/10.1108/LR-03-2016-0028

Salaba, A. 2020. "Knowledge Organization Requirements in LIS Graduate Programs". In *Knowledge organization at the interface*: Proceedings of the Sixteenth International ISKO Conference 6-8 July 2020 Aalborg, Denmark, edited by M. Lykke et al. Advances in Knowledge Organization 17: 384-393.

San Jose State University. 2023. *Competency Statement Rubrics*. https://ischool.sjsu.edu/sites/main/files/file-attachments/289_comprubrics.pdf

University of California Los Angeles. 2023. *M253 Medical Knowledge Representation*. https://seis.ucla.edu/departments-and-degrees/department-of-information-studies

University of North Carolina at Greensborough. (2023). *IST 301 Information Organization*. https://soe.uncg.edu/academics/departments/lis/

University of Maryland. (2023). *INST311 Information Organization.* https://ischool.umd.edu/academics/masters-programs/master-of-library-and-information-science/

University of Michigan. (2023). *LHS 611 Knowledge Representation and Management in Health*. https://www.si.umich.edu/

University of Washington. (2023). *LIS 534 Indigenous Systems of Knowledge*. https://ischool.uw.edu/programs/mlis