Information Organization and Information Retrieval in the LIS Curriculum: An Analysis of Course Syllabi

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Within LIS education, information organization (IO) and information retrieval (IR) are two well-established, foundational, and conceptually interlinked areas of study. They have long maintained a strong presence in the core curriculum, through either dedicated or combined courses. Recent trends in LIS education have seen a greater reliance on a smaller, more condensed core, raising questions about the presence, role, and format of these foundational topics. This study aims to provide a clearer picture of how IO and IR currently manifest in the LIS core, along with which particular IO and IR topics are most prevalent. Through content analysis, course syllabi for 58 IO and/or IR related courses from 38 different, ALA-accredited LIS programs were examined. Course descriptions and schedules of topics were assessed using the ISO 5127 controlled vocabulary as an analytical framework. Findings revealed three main course types: IO dedicated courses, IR-related courses typically in the context of reference services, and combined courses that often presented IO and IR alongside other fundamental topics. Though dedicated courses showed little leveraging of topics from the other areas, combined courses leveraged topics from both IO and IR. Among all courses, the prevalence of the topics of access, classification, databases, and metadata suggests a common area of crossover among IO and IR. Overall, findings point toward greater diffusion of IO and IR content throughout the core curriculum while demonstrating the continuing relevance of these areas.

Keywords: curricula, information organization, information retrieval, library and information science education

Though the library and information science (LIS) domain encompasses a range of topics, two well-entrenched areas of teaching and study are information organization (IO) and information retrieval (IR). Information organization focuses on the development and use of systems to organize information and information resources, and it includes practices such as cataloging, classification, and indexing; some settings may also refer to this area, or aspects of it, as knowledge organization (Hider, 2018, pp. 135–36, 138). Information retrieval concerns the means of selecting and retrieving from a collection of information resources those that are relevant to a particular user's needs (Cool & Belkin, 2011, pp. 1–2). Even at a cursory glance, these two topics would appear to be closely intertwined; resources are represented and

KEY POINTS:

- IO and IR remain fundamental topics within LIS programs and appear prominently within core courses.
- Combined courses covering IO and IR together are becoming more common, as are courses combining IO and/or IR with other foundational topics.
- Key topics such as access, databases, metadata, and classification represent a common area of crossover for IO and IR education.

organized for the purposes of retrieval, while effective retrieval relies on proper ordering and indexing. Such conclusions, however, may be overly reductive; retrieval can be accomplished without prior collection organization, and organization activities allow a range of management tasks beyond retrieval (Lambe, 2007, p. 3). Regardless, in their shared goal of information access, IO and IR are functionally linked, with Hjørland (2021) framing these as separate fields with the same common goal. This functional connection is particularly prominent in LIS programs, applied programs of study tasked with preparing graduate students for information careers.

In their role as foundational concepts in information, IO and IR are both common, long-standing topics of instruction within LIS programs. Along with information literacy they have even been described as the cornerstone of LIS education (Bawden, 2007, p. 135). In fact, these topics typically take the form of dedicated, required courses and have been found to be among the most frequent required courses in LIS programs (Chu, 2006, p. 330). Given their close interrelation, IO and IR have also been taught together in a single course format, though Bawden (2007, p. 134) cites the trend toward curriculum modularization in the 1990s as a major factor in the more common separation of IO and IR into distinct courses in modern programs. As LIS programs continue to adapt to evolving information environments and the changing demands on information professionals, new trends in curriculum design are emerging. Many programs are featuring a smaller, denser core of required courses that are supplemented by an expanding offering of electives (ur Rehman & Alajmi, 2017, p. 98). This arrangement may give programs the flexibility to respond to quickly changing areas of information work but leave less space to address foundational topics. Traditional divisions of such topics are therefore being reconsidered, and recent examination of LIS curricula has shown that some schools are once more merging IO and IR into a combined course (Joudrey & McGinnis, 2014, p. 524). This trend warrants further examination and raises broader questions about how IO and IR intersect within modern LIS coursework.

This study seeks to understand the current interrelation among IO and IR in LIS curricula. Taking ALA-accredited graduate programs in English-speaking settings as the population of interest, this work specifically addresses the following research questions:

1. Among required courses, in what configurations are IO and IR presented (e.g., separate courses, combined course, IO but not IR)?
2. For all required courses featuring IO and/or IR, what topics are being taught?
3. Of these topics, which IO and IR topics are most prevalent?
4. What is the relative balance of IO to IR topics among required courses?

To address these questions, researchers collected syllabi from IO- or IR-related required courses from ALA-accredited LIS programs. Within these syllabi, course descriptions and course schedules were examined using content analysis. This analysis was guided by the controlled vocabulary ISO 5127, "Information and Documentation—Foundation and Vocabulary," which served as a framework to standardize terms and topics. The results offer a current view of how IO and IR manifest in the core of LIS curricula, provide insight into new patterns of LIS curricula organization, and highlight key topics pivotal to these foundational areas of study.

Background

Given the breadth of the information discipline, LIS education must prepare students with both a comprehensive theoretical background and an array of practical skills. In a review of LIS curricula, Bawden (2007, p. 135) argued that IO and IR hold a special place in the core of any such preparation. Indeed, these topics are likely to be included in the required coursework of LIS programs. Even with the fundamentals in place, however, the fast change of pace in information settings and occupations presents a challenge in maintaining any LIS curriculum. Furthermore, not only must the design of these programs take traditional and emerging needs into account, but they must also do so while negotiating the requirements of accrediting bodies such as the ALA (Chow, Shaw, Gwynn, Martensen, & Howard, 2011, p. 1). Chu (2006) found that, in response to all of these demands, many LIS programs have increased elective offerings while decreasing the number of core, required courses. Alajmi and ur Rehman (2016) made similar observations on the balance between electives and core courses in a study of 68 LIS programs across Asia, Europe, and North America. At the same time, surveys of both practitioners and educators have shown a desire to include more content related to theoretical knowledge and soft skills in LIS programs, preferably within required courses (Morgan & Bawden, 2006; Saunders, 2019). While IO and IR continue to be seen as important cornerstones in LIS education, we can see that there is an increasing number of competing demands on what to include in the curriculum, particularly within the small core of required classes.

Information organization has long been considered a core topic within LIS education. In a 2006 study of ALA-accredited programs, Chu (2006) found that IO courses were the most frequently occurring required class. Salaba's (2020) examination of IO courses further supports this finding, noting that 94% of the ALA-accredited programs reviewed had a core course in IO. While previously a more traditional "cataloging and classification" course may have filled this role, programs now are more likely to offer a broader "organization of information" course. Hider (2018, p. 148) attributed this shift to changes in the employment landscape, library technology, and technical services outsourcing. Numerous studies of IO pedagogy have noted this shift away from traditional topics and toward broader, emergent topics such as metadata, ontology, and the semantic web (Alajmi & ur Rehman 2016; Aytac et al., 2011, p. 1; Hsieh-Yee, 2004, p. 4). This is not to say that traditional bibliographic organization is excluded from current IO curricula. In a content analysis of course readings from IO courses at 34 ALA-accredited programs, Pattuelli (2010) found that traditional cataloging and classification remained the heart of this course content but noted that they shared space with an increasing number of topics, including some associated with IR. Joudrey and McGinnis (2014) cited a similar trend with IO courses while noting the difficulties of attempting to cover so many topics in a single course. This trend is likely to continue as professionals and educators consider what IO skills and understandings students will require in the coming years. Snow (2019, p. 149) predicted that increased focus on ethical issues, soft skills, and practice would impact IO education in the coming years, providing much-needed competencies for students though adding to already crowded curricula.

Information retrieval also serves a foundational role in information education, and the teaching of IR has been examined in its own separate body of work. Unlike IO, IR plays

a prominent role in not just LIS programs but in computer science programs as well. In a review of IR pedagogy literature in both domains, Fernández-Luna, Huete, MacFarlane, and Efthimiadis (2009) observed that while computer science IR courses are more focused on building applications, LIS IR courses are more about using search applications. They concluded that, in LIS programs, IR manifests as the development of applied search skills, something they attributed to professional and accrediting bodies' focus on information needs and behaviors (Fernández-Luna et al., 2009, p. 10). In addition, IR courses tend to leverage key IO concepts; this is true even in computer science settings. For example, Goharian, Grossman, Frieder, and Raju (2004, p. 3) described the creation of an IR class within an undergraduate computer science program; the resulting course schedule included several traditionally IO topics such as controlled vocabularies, thesauri, and semantic networks. Ties to IO concepts are even more apparent in LIS courses, though. In a study focused on core curriculum development for a new LIS program, Noh, Choi, and Ahn (2014, p. 161) felt that understanding IR also required a firm grasp of indexing and classification. The resulting IR course that they developed therefore included a number of IO topics such as indexing, thesauri, categorization, abstracting, and metadata (pp. 174–175). Information retrieval does not always take the form of a separate course in information science programs, however. In fact, in an examination of 45 ALA-accredited programs, Chu (2006, p. 330) found that only nine programs at that time contained a dedicated, required IR class. Nicholson (2005) observed that in such programs without an IR course, IR content tended to appear in core courses devoted to IO or to reference and information services. IR content may also appear in courses devoted to information systems and information behaviors (Smith & Roseberry, 2013, p. 257).

Though IO and IR pedagogy are closely linked, their interrelation does not appear to be entirely symmetrical. Chu (2006) found that required IO courses were much more common than required IR courses, and Bawden (2007, p. 134) observed that while standard texts in IR often covered IO topics, IO texts included little discussion of IR topics. Together, Chu's and Bawden's observations may point out a trend of IR education becoming secondary to, or dependent on, IO education. Interestingly, Hider (2018, p. 153) made the opposite speculation, wondering if the automated methods associated with IR would eventually subsume the IO field. This distinction between the automated, computational affinities of IR and the manual, human interventions associated with IO has been explored elsewhere in the literature (for example, see Hjørland, 2008). Certainly, some LIS programs present the two as separate topics; Noh et al.'s (2014) curriculum development study resulted in separate IO and IR courses within the same LIS program. This was in the context of a six-course required core, however, which may be unusually large compared to many other current programs. At the conclusion of his review of LIS curricula, Bawden was supportive of teaching IO and IR in close combination, potentially in the form of a single course. This practice has since begun to re-emerge in LIS programs. Joudrey and McGinnis (2014) noted that of 51 schools requiring an IO course, three required a combined IO/IR course specifically. Though the authors cited this combination as a trend to watch, the combined teaching of IO and IR remains relatively unexplored in the literature.

Methods

The population of interest for this study included graduate courses offered as part of ALA-accredited graduate programs in library and information science. Given the scope of the present study, researchers examined only required courses that featured an emphasis on IO and/or IR. Researchers used the ALA directory (http://www.ala.org/educationcareers/accreditedprograms/directory) to identify accredited programs and their website addresses. Next, publicly available data on each program's website was reviewed to determine the required courses in their graduate program; programs without any required courses were excluded from consideration. Researchers recorded information about any required course associated with IO or IR, using terms identified in the course title and description to make this determination. Identifying terms included "representation," "organization," "metadata," "retrieval," "searching," and "discovery." For all identified courses, syllabi from calendar year 2019 available on school, program, or instructor websites were collected. In cases where syllabi were not available online, researchers contacted programs and/or instructors to request a copy. A total of 124 syllabi were collected.

Within the collected syllabi, researchers were interested in two common sections that typically reflect the content of the course: the course description and the schedule of topics. Out of the 124 syllabi initially collected, 64 syllabi had both description and schedule sections; the remaining 60 were excluded from further analysis. Of the 64, three were not in English and were also excluded from the present study, leaving a total pool of 61 syllabi.

Next, researchers assigned a general course type to each of these courses, signifying whether the course appeared to be more IO-focused, more IR-focused, or some combination of the two. Researchers relied on terms in the title and course descriptions to make these assignments. Two researchers independently assigned types to each of the 61 syllabi, and they agreed on the course type for 58 of these. Reconciliation meetings were used to assign types to the remaining three syllabi.

Term analysis of syllabi

Researchers next conducted term extraction on these syllabi, recording any words or phrases used in the description and schedule of topics sections that conveyed a discrete information concept as a topic of instruction (e.g., "classification," "reference request," "database design"). To record the extracted terms, a coding workbook was created to include the following data: document identification number, extracted term, section where the term appears (schedule or description), context (text surrounding the term), and notes documenting researcher observations about term context.

Next, a pre-coding test was performed, using three sample syllabi: one identified as IO, one identified as IR, and one identified as combined. During the test, two researchers separately coded each of the sample syllabi. This practice process served both as a check-and-balance and to help attune both coders regarding the granularity of terms. A common granularity issue concerned clauses containing terms dependent on other terms earlier in a sentence, for example, as in the phrase "issues surrounding information, data, and knowledge." This was ultimately coded as "information issues," "data issues," and "knowledge issues."

The two coders' results from the pre-coding test were then assessed through a reconciliation meeting presided over by a third researcher. In this meeting, all researchers compared the coding test results for the three syllabi, discussed the discrepancies, and decided on the following rules for the full coding process for the remaining 58 syllabi:

- For any compound concepts (e.g., "organizing and accessing information") three wordings should be identified: "organizing information," "accessing information," and "organizing and accessing information."
- Assignment names should not be coded even if these appear in the schedule section.
- Readings, or any keywords or descriptions given for the readings, should not be coded even if these appear in the schedule section.

Both coders then completed the extraction process for all 58 syllabi. Following this, researchers used the ISO 5127, "Information and Documentation—Foundation and Vocabulary," to map extracted terms to controlled forms. For each of these terms, the text of ISO 5127 was consulted to determine the best term match or matches. If a single term from the ISO completely captured the meaning of the extracted syllabus term, only this ISO term was recorded. In some cases, syllabus terms expressed a compound concept (e.g., "information needs and use"). Here, researchers attempted to match terms for each of the two distinct concepts expressed. Other compounds expressed one very specific concept (e.g., "map indexing"). Researchers decided not to utilize post-coordinate term assignment in these cases; rather than matching terms for both "maps" and "indexing," researchers looked only for a specific match. For each extracted syllabus term, researchers recorded up to three matches from the ISO as applicable. For some terms, no suitable match was present in the ISO, so no ISO term was recorded. This matching was divided among two researchers, who each performed matching for their half of the extracted syllabus terms and then reviewed the matching work of the other. A consensus meeting was used to address and correct any inconsistencies across the term matching.

Mapping to IO and IR

Next, researchers examined the list of all unique ISO 5127 terms utilized during the matching process. In this phase of the procedure, researchers sought to assign matched ISO terms as either an IO topic or an IR topic, where possible. To aid in this assignment, researchers used the structure of the ISO itself for guidance. For example, terms falling under section 3.10, "Search and retrieval," were aligned with IR topics and perspectives. Similarly, section 3.8, "Content analysis and content description," encompassed IO topics such as classifications and thesauri. Other sections were more ambiguous though, for example, 3.2, "Basic concepts for information and documentation."

While major section divisions were used as guidance, researchers examined each term individually and assigned it as *IO*, *IR*, or *neither*, or marked the term as *ambiguous* in that it could reflect both IO and IR content and perspectives. The list of identified ISO terms was examined by two researchers, who made their own assignments and then reviewed the other's assignments. During a subsequent consensus meeting, the researchers discussed any discrepancies, made decisions, and worked to assign any *ambiguous* terms to the *IO*, *IR*, or *neither* categories.

Determining IO and IR representation

Using spreadsheet software, the researchers linked the tables containing course information (including their types—IO, IR, and combined), syllabi terms, unique ISO 5127 terms having been matched, and the *IO*/*IR*/*neither* assignments of those ISO terms. The resulting data set was used to perform descriptive quantitative analysis. This included a frequency analysis of the *IO*/*IR*/*neither* terms in each syllabus, across all syllabi, and within each course type, as well as a presence/absence analysis of the most common IO and IR topics across all courses and within each type of course.

Results

A total of 61 English-language syllabi containing descriptions and course schedules were collected. While three of these were held aside for test coding, the remaining 58 syllabi were used for analysis. These 58 syllabi represent required IO- or IR-related core courses in 38 individual ALA-accredited programs.

Using course titles and descriptions, researchers assigned these syllabi to one of three types: IO, IR, or combined. Table 1 shows the breakdown of courses into these categories, along with sample course titles.

IO courses showed less variation in course title and focus than other types of courses. Courses identified as IR contained a number of courses focused on information resources and services, including those covering reference services. Combined IO/IR courses emphasized both IO and IR within course titles and descriptions; however, this category represented the most heterogeneous group of courses. Of the 21 combined courses, eight were devoted to both IO and IR together (for example, *Information Organization and Retrieval*). The remaining 15 covered both of these topics as part of a broader survey of information and LIS topics (for example, *Information Life Cycle*, *Conceptual Foundations*).

Term analysis of syllabi

Syllabi varied greatly in length and number of terms identified by the coders. The average least number of terms assigned to a syllabus was 15.5, and the average most number of terms was 188.5. Concerning term identification, coders agreed 100% of the time on 13 out of 58 syllabi. For those syllabi in which they deviated, Coder 1 went into greater specificity of identified terms 25 times, while Coder 2 went into greater specificity 13 times. A pairwise *t*-test was used to calculate the difference in coverage based on the assignment of

Table 1: Courses by type

Course type	Sample Titles	Total (*N* = 58)
IO	*Organization of Information; Principles of Cataloging & Classification*	16
IR	*Information Resource Discovery; Information Sources, Services, & Retrieval*	21
Combined	*Description and Access; Perspectives on Information*	21

the frequencies of terms per document; inter-coder reliability was not crucial due to the coding being term identification rather than an independent rating system, which would rely on Cohen's kappa. The mean number of terms assigned per syllabus was 51.181, with $t = 3.350810$, $df = 57$, and a p-value of 0.000717. With statistical significance of $p = 0.05$, a significance of 0.0007 indicates a statistically significant difference in the assignment of terms. Due to the nature of the inductive coding (i.e., that it was term identification instead of a rating system), researchers know that this variation reflected differences in the level of detail with which terms were identified for one coder versus the other. Given that the nature of the deviations in terminology was related to granularity decisions and not content, the third coder decided that these instances did not indicate an actual disagreement. In such cases, granularity discrepancies were resolved by preferring the more encompassing identified term (e.g., "managing and evaluating reference services" vs. "managing," "evaluating," "reference services"). After reconciliation, a final total of 1,928 terms were identified among the 58 syllabi.

Term standardization against ISO 5127 was conducted by both Coder 1 and Coder 2. The results of the ISO matching were resolved by a third researcher using the closest match possible to resolve any discrepancies. The results were then reviewed by all three researchers for integrity. Of the 1,928 syllabi terms identified, 1,158 were matched to one or more ISO terms, while 770 had no comparable term in the ISO. Table 2 shows the results of the ISO matching process. In many cases, multiple syllabus terms resolved to the same ISO term (e.g., "database design" and "database structure" matching to "database"). As such, a total of 304 unique ISO terms were identified as matches to the 1,158 syllabus terms.

Mapping to IO and IR

Researchers next assigned all 304 unique ISO terms as one of *IO*, *IR*, or *neither*, or *ambiguous*. During consensus meetings, all 26 terms initially marked *ambiguous* were resolved to either *IO* or *IR*. Table 3 shows the results of this phase. Of the terms, 142 were assigned as *neither*. In most cases, these terms represented foundational concepts (e.g., library, recorded information) or concepts specific to other areas of library and information science such as policy or preservation (e.g., copyright, digitization).

Table 2: Syllabus term and ISO term matching

Match	Count (N = 1,928)	Example syllabus term	Example ISO match
1 match	1,071	information access	access
2 matches	72	virtual reference interviews	virtual reference; reference interview
3 matches	15	school, public, and academic libraries	school library; public library; academic library
No matches	770	cultural competence	n/a

Table 3: ISO terms assigned to topic

Topic	Count (*N* = 304)	Example ISO terms
IO	120	categorization; access point
IR	42	browsing; search evaluation
neither	142	library; copyright; big data

Table 4: IO, IR terms across all syllabi

Term type	Percentage of syllabi terms
IO terms	34.7%
IR terms	20.9%
Neither IO or IR	44.4%

Table 5: IO, IR terms across syllabi by type

Term type	Percentage within IO syllabi	Percentage within IR syllabi	Percentage within combined syllabi
IO terms	73.5%	5.2%	34.5%
IR terms	10.8%	27.3%	22.2%
Neither IO nor IR	15.6%	67.5%	43.3%

IO and IR representation

Using the ISO matched terms and their assignments to *IO*, *IR*, or *neither*, researchers calculated the relative proportions of *IO* terms, *IR* terms, and terms not considered either *IO* or *IR* across all 58 syllabi. Table 4 shows the results of this analysis. Across all syllabi, terms that indicated a topic that was neither *IO* or *IR* were most common, followed by *IO* terms, then *IR* terms.

Within IO syllabi, *IO* terms occurred most frequently, accounting for 73.5% of terms, with *IR* terms accounting for a further 10.8% and terms that were neither *IO* or *IR* accounting for the remaining 15.6% of terms. Within IR syllabi, terms that were neither *IO* or *IR* accounted for the majority of terms. Within combined syllabi, terms that were neither *IO* or *IR* were again the most common, followed by *IO* and then *IR* terms. A more granular breakdown of percentage of term occurrence by course type is contained in Table 5.

Table 6: Most common IO, IR terms across all syllabi

ISO term	Term type	All syllabi (*N* = 58)	IO syllabi (*n* = 16)	IR syllabi (*n* = 21)	Combined syllabi (*n* = 21)
knowledge organization	IO	28	13	2	13
metadata	IO	27	15	1	11
search and retrieval	IR	23	2	13	8
access	IR	22	9	5	8
classifying	IO	22	11		11
description (1) <activity>	IO	22	13		9
database	IR	20	2	10	8
search strategy	IR	17		14	3
information retrieval	IR	16	6	3	7
use of information	IR	16	2	7	7
authority control	IO	15	10		5
controlled vocabulary	IO	15	6	2	7
classification system	IO	14	8		6
retrieval system	IR	14	2	5	7
subject analysis	IO	13	9		4

Individual ISO term coding at the binary presence/absence level across all syllabi offers a view of the most common topics occurring within the various types of courses. Table 6 shows the 15 most common *IO* or *IR* ISO terms associated with the syllabi. Only the presence of the ISO term is considered, not the number of times it occurred in association with any particular syllabi. For example, terms corresponding to the ISO term "knowledge organization" occurred at least once within the description or course schedule for 28 different syllabi (16 IO, two IR, and 13 combined.)

The most frequently occurring terms represent a mixture of both IO and IR topics, following a long tail distribution. ISO terms marked as neither *IO* nor *IR* were excluded from the initial view presented in Table 6. Tables 7–9 take all ISO-matched terms into account when presenting a deeper look at the most commonly associated ISO terms for each of the three course types. These tables again show occurrences at the presence/absence level, here for the top 12 occurring terms in each set. The top 12 terms illustrated major trends within each course type and served as a reasonable cut-off for the long tail of term distribution.

Overall, the most commonly occurring ISO terms in IO courses were marked as *IO*, while within combined courses, a mixture of both *IO* and *IR* terms were present. Within IR

Table 7: Most common ISO terms in IO syllabi

ISO term	Term type	IO syllabi (*n* = 16)
metadata	IO	15
description (1) <activity>	IO	13
knowledge organization	IO	13
information literacy	neither	12
classifying	IO	11
authority control	IO	10
linked data	IO	10
access	IR	9
categorization	IO	9
subject analysis	IO	9
classification system	IO	8
semantic web	IO	8

Table 8: Most common ISO terms in IR syllabi

ISO term	Term type	IR syllabi (*n* = 21)
reference interview	neither	16
reference service	neither	15
information service	neither	14
search strategy	IR	14
evaluation	neither	13
search and retrieval	IR	13
reference work	neither	12
bibliographic instruction	neither	11
information resource	neither	11
database	IR	10
library	neither	9
information need	IR	8

Table 9: Most common ISO terms in combined syllabi

ISO term	Term type	Combined syllabi (*n* = 21)
information	neither	13
knowledge organization	IO	13
classifying	IO	11
metadata	IO	11
description (1) <activity>	IO	9
access	IR	8
database	IR	8
information system	IR	8
search and retrieval	IR	8
controlled vocabulary	IO	7
information retrieval	IR	7
retrieval system	IR	7

courses, *IR* terms were common, though terms marked as *neither* were the most frequently occurring and encompassed a number of terms associated with information services and reference work.

Discussion

In examining syllabi for this study, researchers chose to divide them into three types of courses: IO, IR, and combined. This division was meant to reflect long-standing course types in LIS programs, as well as more recent trends noted within the literature (Chu, 2006; Joudrey & McGinnis, 2014). The way in which each course was intended to function in the context of its program may not match the type assigned here. Though a course's role within its program was not evaluated as part of the present study, there are opportunities to examine this more closely in subsequent work. Still, course titles and descriptions largely matched the literature and researcher expectations concerning the three types of courses. Overall, courses considered more IO-related were fairly homogenous in scope and content when compared to IR-related and combined courses. Courses considered IR in the present study included many reference services courses; these courses have long been recognized as a primary source of IR training in programs without other dedicated IR classes (Nicholson, 2005). Accounting for 21 out of the 58 syllabi analyzed, combined courses represented a significant portion of those examined. Here, several types of courses were included, from the focused IO/IR combinations noted by Joudrey and McGinnis (2014), to more general courses covering a variety of fundamental information topics. We identified eight courses

matching Joudrey and McGinnis's criteria, as opposed to their three courses, potentially demonstrating an increasing trend; follow-up studies are warranted. With many LIS programs now featuring smaller cores (Chu, 2006), it is likely that many LIS students are receiving IO and IR instruction in combination formats rather than dedicated courses.

Overall, IO topics were more numerous and prevalent within syllabi than were IR topics. Of the 304 ISO terms matched to syllabi terms, *IO* terms accounted for over a third of matched terms, and nearly 2.9 times more terms than *IR* terms (120 vs. 42). This suggests that a wider variety of discrete, and officially documented, IO concepts are being taught within core LIS courses compared with IR concepts. With respect to specific course types, *IO* terms accounted for 73.5% of syllabi terms in IO-related courses. In comparison, these courses featured very few *IR* or *neither* terms, showing a tight focus on IO topics. Within IR-related courses, *IO* terms accounted for roughly 5% of syllabi terms, suggesting little presence of IO content within IR courses. This is somewhat surprising, given the tight ties between IO and IR in information science (Hjørland, 2021). Nevertheless, *IO* terms were some of the most frequently occurring across syllabi as a whole, especially "knowledge organization," "metadata," "classifying," and "description." IO courses also included emergent topics such as "linked data" and "semantic web," while more traditional topics such as "cataloging" appeared less frequently. This may suggests within these courses a shift toward newer trends and an emphasis on broader information principles (e.g., "description" rather than "cataloging"), findings that have previously been reported (Alajmi & ur Rehman 2016).

Results suggest that IR topics currently play a less prominent role within the LIS core than do IO topics. Of the 304 ISO terms matched in this study, only 42 were identified as *IR* terms. When cross-referenced with the syllabi terms, these *IR* terms accounted for only 20.9% of syllabi terms. Even within IR courses the majority of ISO terms were marked as *neither*, with only 27.3% of terms being *IR*. This is somewhat unexpected, considering there were more IR-related courses in the sample than IO-related courses. Together, these findings suggest a tighter focus on a smaller number of IR concepts within the LIS core, as well as a stronger emphasis on applied settings of IR, specifically reference work. The most prominent *IR* terms across all syllabi were "search and retrieval," "access," "search strategy," and "database." Within the IR courses, the majority of terms weren't IO or IR but indicated links to reference and information services topics (e.g., "reference interview," "reference service," "information service"). This may reflect the fact that in programs without dedicated IR courses, students are most likely to engage IR topics in reference courses (Nicholson, 2005). Indeed, many of the courses identified as IR-related for this study appear to present IR topics in an applied scenario of reference and user services, as opposed to more technical or theoretical settings. Surprisingly, results showed less leveraging of IO topics within IR-related courses and stand in contrast to the IR course design advanced by Noh et al. (2014).

Of the three course types identified in this study, the combined courses showed the most even leveraging of both IO and IR topics. Specifically, topics including access, classification, metadata, search, and databases stand out as common areas of convergence. The importance of IO- and IR-focused topics within the combined classes reinforces Bawden's (2007) assertion that these areas form the foundation of LIS education. The combined courses took a number of forms, from deliberate combinations of IO and IR to more

general foundations courses encompassing a range of LIS areas. IO and IR would appear to retain their place as fundamental concepts, even if interwoven as part of a larger tapestry of information. That said, combined classes featured a higher number of more discrete IO topics compared to IR topics, which were fewer and more general. This may, in part, reflect the level of granularity assigned to these areas within the ISO vocabulary. In addition, the theoretical versus practical nature of each topic is unclear without further study. Recent surveys suggest a greater emphasis on the theoretical framing of topics in core courses (Saunders, 2019), though the distinction between theory and practice is often not apparent within a schedule of course topics. Finally, though not present within this study's findings, the incorporation of data science topics into LIS curricula may present another opportunity for convergence of IO and IR topics (Bukhari, 2020; Mo, Seon, Park, & Kim, 2019); this trend should be closely followed in the future.

The findings of this study reveal more about how IO and IR manifest and relate within LIS core curricula today. These findings must be tempered by several limitations of the approach employed here. First, due to the prominence of IR terms within their descriptions, reference and information services courses were classified as IR-related within this study. While justifications have been provided above for this choice, it could still be argued that these courses are not intended to serve as IR courses. Furthermore, though many reference courses were classified as IR, reference topics in the ISO vocabulary were classified as neither IO nor IR. These decisions resulted in a high number of *neither* terms within the IR courses. Second, when matching syllabus terms to the ISO, almost 40% of these terms had no match within the ISO. Many of these terms relate to social issues and topics in information, including cultural competence, diversity, and social media. While the relative absence of these terms in the ISO may have made IO and IR topics appear more prominent within each of the course types, it also raises questions about the goals and coverage of the ISO vocabulary. Finally, moving forward from the present work, consideration of elective courses, analyses of course readings, and interviews with LIS course teachers may provide further insight into the roles of IO and IR in the curriculum.

Conclusion

This study presents an examination of the presence and relationship of IO and IR in current LIS curricula. Our review of syllabi for core courses in these programs shows that IO and IR topics appear prominently. Courses dedicated to one of these two areas remain common, though dedicated IO courses occurred more frequently, and IR-related courses were often heavily centered on reference and information services settings. Findings also support the previously noted trend of courses merging IO and IR, though they also revealed varying configurations for this merger, from dedicated combined courses to information fundamentals courses covering IO and IR alongside other foundational LIS areas. Within the three identified course types, researchers found that IO and IR courses did not leverage topics from the other area as much as expected. IO courses focused on a larger number of IO concepts, while IR courses focused on a smaller number of IR topics in addition to topics related to user-based reference services. Combined courses drew on both IO and IR topics, though IO topics were more common. Overall, the frequently occurring topics of

classification, metadata, access, and databases suggest a concentrated area of IO/IR crossover within the LIS core.

Overall, the present work adds to our current understanding of the inclusion of IO and IR concepts in LIS education, as well as the nature of core, required courses within LIS curricula. Specifically, findings show IO and IR becoming more diffused through the core, and they point toward new combinations and configurations of these topics while affirming their enduring importance. The use of the ISO 5127 vocabulary provided a useful analytical framework for evaluating patterns within these findings, though it presented some limitations as well; a separate line of inquiry examining the presence and role of social topics in this vocabulary is warranted. Additional opportunities also exist to build on the present study. Examination of elective courses, as well as gathering the views and opinions of LIS educators, promises to further expand our understanding of the roles IO and IR in LIS education.

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