Evidence Based Library and Information Practice

Syllabus Mining for Information Literacy Instruction: A Scoping Review

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Résumé de l'article

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Objectives - The present study uses a scoping methodology to examine syllabus mining of Information Literacy with the focus of analysis on the methodologies employed in syllabus review and the recommendations from the studies.

Design - Searches of databases of literature from librarianship and education, as well as a multidisciplinary database, yielded 325 journal articles. Inclusion criteria specified peer-reviewed articles from any year, and excluded grey literature. After removing duplicates, 2 reviewers screened titles and abstracts and reviewed full text, yielding 17 studies to analyze.

Results - Characteristics of the included studies, methodology, and recommendations were charted by two reviewers. All studies reported retrieving information that increased opportunities for collaboration with instructors and targeted engagement with students, and seven themes were identified.

Conclusions - Instructional librarians should be encouraged to conduct syllabus studies to increase collaboration with faculty to develop coursework, to meet student information needs in a strategic manner, and to identify discipline-specific Information Literacy concepts.

Evidence Based Library and Information Practice

Review Article

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Abstract

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research that uses syllabus mining to track Information Literacy concepts and skills in academic settings.

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Introduction

Course syllabi provide a roadmap to instructional goals and the development of the student as scholar. Although syllabi may present challenges with accessibility and inconsistency, and contain incomplete or vague content, they are one tool instructional librarians can use to coordinate Information Literacy (IL) instruction with a course. Student learning objectives (SLOs) in syllabi show concepts suitable for instruction, helping librarians coordinate the timing of instruction and skill development (Miller & Neyer, 2016).

One reason for studying research on syllabus mining is to see how IL has evolved over time. Perceptions of IL are still evolving, beginning with bibliographic instruction and moving to IL Standards, and in 2018, the creation of the IL Framework. Many disciplines and accreditation agencies now incorporate IL concepts as part of their professional competencies (AAC&U, n.d.; ACHE Healthcare Executive Competencies Assessment Tool, 2020). Examining the syllabus of a course is an effective way to determine how IL is reflected and will help the library instructor put the necessary IL skills and concepts into relevant context.

Another reason to study syllabus mining is to identify ways library instructors can collaborate with faculty (Williams, et al, 2004; Dubicki, 2019). By examining syllabus course objectives, the librarian has information to suggest timely and relevant literacy instruction to faculty and create support materials in subject guides or build instructional modules for integration in online learning systems.

Williams, Cody, and Parnell (2004, p.270) sum up the importance of syllabi studies to academic libraries: "key to embedding the library into the student experience is to be an integral part of the course work. The most detailed evidence of what that coursework entails is the syllabus. Therefore, obtaining and analyzing syllabi for existing and potential library collaboration are valuable endeavors for librarians."

Historically, syllabus studies in library research examine different outcomes. Rambler (1982, p.156) is credited with the first study in library research to examine the syllabi across an

academic setting to identify assignments that require library resources and services: "In essence, decisions and actions based at least in part on findings from a syllabus study can facilitate the creation of the ideally responsive and completely curriculum-integrated library." Other studies look at how the syllabus reflected or influenced library usage (Dewald, 2003; Lauer, 1989) or collection development (Lukes et al., 2017). This scoping review aims to systematically search for library research utilizing syllabus studies and Information Literacy objectives or instruction in academic settings to provide an overview of what research has already been done and help inform new research.

Why a Scoping Review?

A systematic review "uses explicit, systematic methods that are selected with a view to minimizing bias, thus providing reliable findings from which conclusions can be drawn and decisions made" (Liberati et al., 2009, p. e2). The strict methods used in a systematic review and a scoping review are designed to minimize bias in study selection and analysis and provide transparent and replicable study design. However, unlike a systematic review, a scoping review is designed to look at literature on a topic without an analysis of quality, so it reveals an overview of all research on a broad topic. The results of a scoping review will not necessarily point to new or best practices or answer a clinical question, but will show the breadth of research conducted on a topic. (Arksey & O'Malley, 2005; Peters et al., 2015).

This scoping review follows the five stages outlined by Arksey and O'Malley (2005): 1) identifying the research question, 2) identifying relevant studies, 3) study selection, 4) charting the data, and 5) collating, summarizing, and reporting the result. Also consulted was the scoping review checklist published by The Preferred Reporting Items for Systematic

Reviews and Meta-Analyses (PRISMA) in 2018, which includes 20 essential items. (Tricco et al., 2018)

The topics of this scoping review are:

- How has syllabus mining or syllabus review been used by librarians to inform Information Literacy instruction in the academic setting?
- What methods for analyzing syllabi are described in library and information science literature?
- What are the conclusions or recommendations of these studies for IL instruction?

Methods

A protocol established by the authors identified inclusion and exclusion criteria. The protocol is registered at Open Science Framework, February 26, 2020, osf.io/9ur2n, "Syllabus mining for Information Literacy instruction: A scoping review protocol."

Eligible articles for inclusion must be in the English language and peer reviewed. Only syllabus studies of college or university classes (undergraduate and graduate levels) in any discipline were included. Grey literature was excluded as were studies using syllabi created by librarians for information literacy. No dates were specified, so selected databases were searched without date limits. The search was completed in May 2019.

The searches were performed in the databases that index library research and education research: Library and Information Sciences Abstracts, Library and Information Technology Abstracts, ERIC, and Education Research Complete. Web of Science was searched as the multidisciplinary database available to the reviewers.
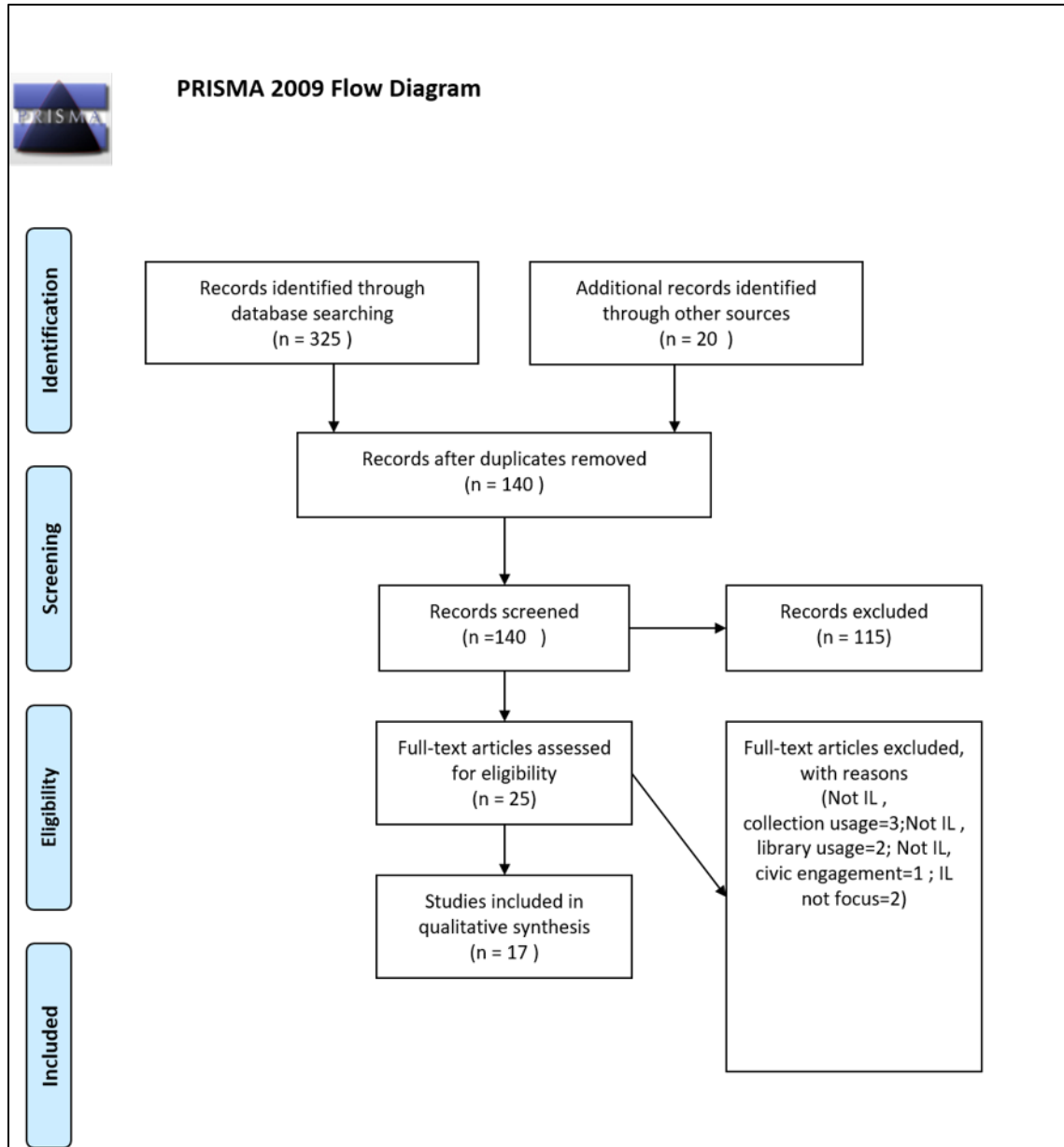
Figure 1
PRISMA Flowchart

The search strategy used keywords and controlled vocabulary to reflect concepts of "information literacy" and syllabus.

The following search was executed in [Library Literature and Information Science Index Full Text](#) and Library and Information Science and Technology Abstracts databases using keywords and descriptors (DE):

1. (Syllabus or syllabi)
2. ("information literacy" or "librar* instruction" or "librar* teach*" or "bibliographic instruction" or "library research")
3. (DE "Information literacy" OR DE "Electronic information resource literacy" OR DE "Health literacy" OR DE "Internet literacy" OR DE "Media literacy")
4. 2 or 3
5. 1 and 4

Source Selection

Search results were collected using Zotero (https://zotero.org), a citation management software, and duplicates were removed using that software's feature. Two reviewers independently conducted abstract review using Rayaan (https://rayyan.qcri.org/) software. The reviews were blinded (reviewer did not know other reviewer's decision) using Rayaan's feature to help minimize bias. Any differences in include/exclude decisions were resolved with discussion. The reviewers piloted a checklist of inclusion/exclusion criteria for full text review in Rayaan and differences were resolved with discussion. In addition, the reviewers checked the bibliographies of selected articles and, after a second review, decided to include two studies previously excluded. The PRISMA flowchart (Figure 1) reflects the steps of the selection and review process.

Data Charting

A preliminary Excel sheet with categories was created, and two articles were independently charted by two reviewers. The results were compared, and after discussion the chart was fine-tuned with additional categories before charting all articles. After all articles were charted, reviewers agreed some categories (academic units, class standing, and number of syllabi; methodology and analysis) should be combined.

Variables charted for each article included:

- purpose or research question(s)
- academic units
- graduate or undergraduate classes
- number of syllabi retrieved
- methodology and methods of analysis
- indicators for Information Literacy instruction
- IL standards used
- results
- recommendations
- limitations
- themes

Results

Search results yielded 325 journal articles, and an additional 20 articles were identified through citation analysis of chosen articles. Duplicates were removed and 115 articles were eliminated because they did not meet predetermined criteria. The resulting 25 articles were examined in full text, and eight articles were eliminated because Information Literacy was not the focus of the research or they focused on library usage or collection development. The total number of articles for synthesis was 17.

One article (Rambler, 1982) was not included in the final analysis, even though it is cited

Table 1
Study Characteristics

Citation	Purpose	Academic Units	# of Syllabi
Undergraduate Course Syllabi Studies			
Alcock & Rose., 2016	1) Examine difference in disciplinary IL & instruction; 2) Identify gaps & opportunities to integrate instruction	History and Chemistry	48
Dewald, 2003	1) Identify faculty expectations of library use and research for undergraduate business students.	School of Business	Not explicitly stated
Dinkelman, 2010	1) Identify research components of IL learning outcomes; 2) Examining IL instruction in a single discipline.	Biology (majors only)	104
Lowry, 2012	1) Identify faculty expectations of Library use for undergraduate business students	Business/Accounting	66
McGowan, et al.,2016	1) See how IL courses aligned with ACRL IL Standards.	Multi-disciplinary (all)	1153
Miller & Neyer, 2016	1) Identify research components of IL learning outcomes; 2) Map nursing curriculum to multiple published IL standards.	Nursing	25
Morris, et al., 2014	1) Identify expectations of history faculty for archival research skills; 2) Create a list of archival research competencies.	History	37
O'Hanlon, 2007	1) Identify relationship of institutional learning outcomes to library research skills instruction; 2) Develop a better understanding of faculty implementation of learning outcomes in the classroom.	Multi-disciplinary	71
Smith, et al., 2012	1) Identify gaps and opportunities to integrate IL instruction; 2) Examine differences in disciplinary IL instruction; 3) Examined library usage expectations	Multi-disciplinary (all)	144
Stanny, et al., 2015	1) Review syllabi for best practice components and IL was a part of this assessment.	Multi-disciplinary (all)	1153
VanScoy, & Oakleaf, 2008	1) Assess research skills needed by incoming college freshman; 2) Identify gaps and opportunities for curriculum-based IL instruction.	Multi-disciplinary (all)	139
Undergraduate and Graduate Course Syllabi Studies			
Beuoy,& Boss, 2019	1) Establish methodology for syllabus analysis using ACRL Framework; 2) Identify opportunities for scaffolded/tiered IL instruction; 3) Examine Disciplinary IL instruction	Media, Culture & Communication; Food Studies; & Teaching & Learning	104
Boss, & Drabinski, 2014	1) Identify opportunities for curriculum-integrated IL instruction in School of Business classes.	School of Business	79

Dubicki, 2019	1) Align IL instruction with IL in syllabus/curriculum; 2) Opportunities for scaffolded/tiered IL instruction.	Multi-disciplinary	180
Jeffery, et al., 2017	1) Identify library resources and people in syllabus; 2) Identify library engagement opportunities 3) Establish methodology for syllabus analysis.	Multi-disciplinary;	1258
Maybee, et al., 2015	1) Identify expectations for student learning in IL and Data IL	Nutrition; Political Science	88
Willingham-McLain, 2011	1) Examine articulation of learning outcomes; 2) Determine alignment of student learning outcomes in syllabi with Institutional outcomes.	Multi-disciplinary (10 schools)	280

frequently by research and considered a foundational study. While it is cited as the first syllabus study to address library integration, the outcomes were related to library usage and not specifically Information Literacy instruction. Thus, this study is outside the scope of this syllabus review.

Synthesis of Results

Purpose of Research (Table 1 Characteristics)

The overall purpose of these research studies was to coordinate library IL instruction with course and faculty expectations. Investigators hoped the results would identify opportunities for, and find gaps in, IL instruction (Alcock & Rose, 2016; Dinkleman, 2010; Jeffrey et al., 2017; Smith et al., 2012) and better collaboration with faculty (Dubicki, 2019; Lowry, 2012; McGowan et al., 2016; Stanny et al., 2015; Dewald, 2003). Several articles discussed the place of library IL in overall curriculum development, and looked for ways to scaffold, embed, or tier instruction (Beuoy & Boss, 2019; Boss & Drabinski, 2014; Dinkelman, 2010; VanScoy & Oakleaf, 2008; Willingham-McClain, 2011). Also, aligning course objectives with IL standards or institutional IL standards was present in several articles (Willingham-McClain, 2011; Beuoy & Boss, 2019; McGowan et al., 2016; Miller & Neyer, 2016; Dubicki, 2019). Identifying IL components of disciplinary competencies was key in accounting (Lowry, 2012), nursing (Miller

& Neyer, 2016), biology (Dinkleman, 2010) and other disciplines (Maybee et al., 2015; Dewald, 2003). Developing IL competencies specific to archives (Morris et al., 2014) and data (Maybee et al., 2015) were prominent in two studies. Jeffrey et al. (2017) hoped to establish a methodology for syllabus analysis.

Academic Units, Number Grad/Undergrad (Table 1 Characteristics)

There was a wide variation in number of syllabi included in research design. A total of 1153 syllabi were retrieved and analyzed in 2 different papers by the same group of researchers. In the first paper, IL was a piece of the overall evaluation and the study was a collaboration between the librarian and institutional entities evaluating syllabi for best practices (Stanny et al., 2015). The same data set was examined more closely for IL outcomes in the second article (McGowan et al., 2016). The smallest set was 13 syllabi from Chemistry courses (Alcock & Rose, 2016) compared to 35 syllabi retrieved from History courses. The author acknowledged the small set was not generalizable but did offer insight into the instructors' expectations for IL.

Six studies looked at a combination of graduate and undergraduate courses *(see Table 1)* and 11 studies examined syllabi from undergraduate courses only. There was not a study that examined graduate course syllabi only.

Eleven studies analyzed syllabi for a range of disciplines (*Table 1)*, but 6 studies focused on individual disciplines, specifically, biology, accounting, nursing, history, and business. Two papers provided direct comparisons of two disciplines, contrasting science, humanities, and social sciences—history vs chemistry, and nutrition vs political science.

The indicators for IL content reflected tasks, assignments and concepts:

- Tasks that reflected library resource usage –find articles, find statistics (VanScoy & Oakleaf, 2008; Lowry, 2012; Alcock & Rose, 2016; Dewald, 2003).
- Assignments including independent use of the library, research papers, annotated bibliographies (McGowan et al., 2016; Dubicki, 2019).
- Statements in the syllabus that reflected IL concepts:
    - SLOs: academic integrity, critical thinking (Dubicki, 2019)
    - IL competencies from discipline standards—AACN Nursing (Miller & Neyer, 2016); Canadian accounting (Lowry, 2012)
    - Institutional curriculum goals (Willingham-McLain, 2011)
    - ACRL standards (McGowan et al., 2016), ACRL Framework (Boss & Drabinski, 2014; Beuoy & Boss, 2019)
- SLOs in syllabus compared to IL concepts from ACRL (Stanny et al., 2015; Miller & Neyer, 2016; McGowan et al., 2016; Lowry, 2012; Dubicki, 2019; Beouy & Boss, 2019) AAC&U (Miller & Neyer, 2016; Boss & Drabinski, 2014; Alcock & Rose, 2016), or Middle States Commission on Higher Education (Willingham-McClain, 2011).

The Lauer/Dewald rating scale was used by multiple studies to score the syllabi from 0-4 (used by Smith et al., 2012; Lowry, 2012; Dewald, 2003). A score of zero was assigned if a syllabus showed no research or library use, one point was given to a syllabus with reserve readings, a score of two meant students were required to complete optional readings not on reserve, three points were awarded for shorter writing assignments or presentations, and four points were awarded to a syllabus reflected a significant research project (10 pages or 20% of grade).

Boss and Drabinski (2014) developed a list of questions, each related to an ACRL frame. Responses were scored 0-2 for each frame, with a possible total of 12 points (used by Alcock & Rose, 2016; adapted by Beouy & Boss, 2019). A list of questions derived from O'Hanlon (2007) were used by Dinkleman (2010) to evaluate syllabi but not assigned a score.

Most studies reported results in terms of percentages of syllabi that contained IL concepts or assignments (*Table 3*). Percentages varied by discipline (Alcock & Rose, 2016; Dinkelman, 2010; Lowry, 2012; Morris et al., 2014). Science classes showed fewer assignments that required library research (Alcock & Rose, 2016; Dinkelman, 2010). History, as a subject in Arts & Humanities, required many more library research assignments (Alcock & Rose, 2016; Morris et al., 2014). Percentages of IL present in syllabi differed by which indicators were used in assessment, and for this reason, comparison of studies is problematic. VanScoy & Oakleaf (2008) looked for statements in syllabi that required finding any library material and scored a 97% rate in syllabi. Independent research was used as an indicator of IL in Boss and Drabinski, (2014) with a rate 73%, and also in Alcock and Rose (2016) showing History at 85% and Chemistry at 39%.

Rubrics, scales, or questions were used by multiple reviewers as evaluation tools for syllabi, so interrater reliability was an important consideration. Interrater reliability was

Table 2
Indicators for Information Literacy in Syllabi

Indicators of IL	critical thinking	evaluating sources	integrate multiple viewpoints	academic integrity	form research question	annotated bib; presentations; book reports	research paper/project	independent research	Data	use reserves; find articles, etc
Alcock & Rose, 2016	X		X	X			X	X		
Beuoy & Boss, 2019	X	X	X	X	X			X		
Boss & Drabiniski, 2014	X		X	X			X	X		
Dewald, 2003						X	X			X
Dinkleman, 2010		X				X	X			X
Dubicki, 2019						X	X	X		X
Jeffrey et al., 2017						X	X		X	
Lowry, 2012						X	X			X
Maybee et al., 2015	X	X						X	X	
McGowan, 2016						X	X	X		
Miller & Neyer, 2016	X	X	X	X	X					
Morris, 2014										X
O'Hanlon, 2007							X	X		X
Smith et al., 2012						X	X			X
Stanny et al., 2015							X	X		
Vanscoy & Oakleaf, 2008									X	X
Willingham-McLain, 2011	X	X		X	X					

Table 3
Methodology and Analysis of Studies Reviewed

Citation	IL Standards used in Analysis	Syllabi with IL Indicators (%)	Analysis
Alcock, E., & Rose, K., 2016	ACRL Framework; AAC&U	History 85% (independent research); Chemistry 39% (independent research)	Used a question list requiring yes/no answers; also searched for keywords in the text. Bias was minimized by using yes/no answers and double coding. Quantitative methods.
Beuoy, M., & Boss, K., 2019	ACRL Framework	not specifically reported	Used the Boss & Drabinski (2014) scale and adapted it to the ACRL IL Framework. Normed a randomized set of syllabi; inter-rater reliability was calculated using Cohen's kappa. Used NVIVO for analysis of syllabi text. Used scale to review syllabi for the presence of the 6 IL frames. Assigned each syllabi a score of 0-2 based on the frame presence. Quantitative methods.
Boss, K., & Drabinski, E., 2014	AAC&U	73%	Developed questions based on the AAC&U VALUE rubric to measure presence of IL concepts in syllabi. Two raters evaluated syllabi independently and compared. Normed a set of three unrelated syllabi at beginning and measured inter-rater reliability using Krippendorf's alpha and Stemler's per cent agreement method. Quantitative methods.
Dewald, N., 2003	None	52.90%	Modified the scale developed by Lauer et al. (1989) to include non-library research, e.g. online research or personal contact. Analyzed syllabi and scored them according to the scale. Quantitative methods.
Dinkelman, A. L., 2010	None	25% (biology)	Combined rubrics/question lists from Holiday & Martin (2006) and O'Hanlon (2007) and then added several other questions. Norming was not done. Used the combined list to evaluate syllabi for the inclusion of IL concepts. Data were collected on Excel sheets. Quantitative methods.

Dubicki, E., 2019	ACRL Framework	81%	Syllabi were analyzed to identify SLOs, research assignments, library services and resources. Data were collected using Excel spreadsheets listing courses by level and course codes. Columns contained the possible IL indicators on a syllabi and their presence was marked with a check. Faculty defined learning outcomes were then mapped to the ACRL IL Framework.
Jeffery, K. M., et al., 2017	None	21% (research)	Obtained spreadsheet for syllabi metadata and wrote script to use to download syllabi from the DSpace repository. All syllabi (1258) were converted to PDF and imported into QDA Miner. Metadata were applied to each document. Developed list of keywords related to library, library services, spaces, and research assignments. Similar keywords were grouped to form codes. Coded syllabi (1226 or 17% of classes) were analyzed. Used Sorenesen's coefficient of similarly to map relationships between codes.
Lowry, L. 2012	ACRL Standards; Canadian professional accounting competency standards: Canadian Institute of Chartered Accountants; Certified Management Accountants Canada and Certified General Accountants Canada	12% (upperclass Accounting)	Collected accounting syllabi for 1 academic year. Modified Dewald's (2003) revision of the scale developed by Lauer et al. (1989). The current revision included questions related to the use of course management systems for linked readings. Author coded syllabi using the modified 5 pt scale. Evidence-based methods. Quantitative methods.
Maybee, C., et al., 2015	None	13.8% (undergrad Political Science) 17.9% (undergrad Nutrition Science) 57.1% (Grad Political Science) 69% (Grad Nutrition Science)	Used Grounded Theory approach. Used two teams, one for each subject area. Teams read though syllabi and did initial coding. Syllabi were reviewed a second time by teams and coding results were discussed. Categories of code groups were created and memos discussing each category were written (iterative process). When consensus was reached on the categories, the teams reviewed them to identify the themes. Qualitative method.
McGowan, B., et al.,2016	ACRL Standards	79%	Developed a rubric to measure if student learning outcomes were aligned with the

			ACRL IL Standards. Rubric was normed using 110 syllabi randomly selected for training with graduate student reviewers. Conducted weekly calibration checks with coder pairs; computed inter-rater agreement. Agreement scores improved during the process. Quantitative methods.
Miller, M., & Neyer, L., 2016	ACRL IL Standards; AAC&U VALUE Rubric; ACRL Standards for Nursing; AACN standards (Nursing);	not specifically reported	Collected all syllabi for nursing classes (n=25) and assignment descriptions. Data were transferred to spreadsheets along with keywords from the course description, course objectives, etc. Learning Outcomes were then mapped to the AAC&U VALUE Rubric for IL and written communication. Mapping was also done to the ACRL Standards for both IL (2000) and for Nursing (2013). A crosswalk was developed with the AACN Essentials (2008).
Morris, S., et al., 2014	None	60% (primary sources)	University Archivist developed a list of indicators of archival activities and syllabi were analyzed to identify classes with any of these indicators present. Conducted interviews with select History faculty regarding their expectations for student development of archival awareness and research skills. Revised list of archival competencies using suggestions from faculty. After list was revised, sent the list to all history faculty for the feedback. Mixed Methods.
O'Hanlon, N. 2007	None	not specifically reported	Conducted web-based survey of faculty focused on writing assignments and research related tasks used in classes as wells as information research skills in students. Reviewed syllabi from interested survey respondents or syllabi that were found on the Internet. Syllabi came from second writing classes and senior capstone courses. Mixed Methods.
Smith, C., et al., 2012	None	57%	Gathered syllabi from Registrar (5173 course sections). Filtered out certain class types: First Year Composition, Graduate, laboratory classes and directed research classes. Randomly sampled the remaining syllabi (n=1496) to get a subset of 200 syllabi. Requested syllabi for these classes from instructor with a return rate of 52% (144

			syllabi). Used Dewald's modified version (2003) of the Lauer et al. scale (1989). Syllabi were coded by pairs of reviewers and disagreements were noted. All disagreements on syllabi were then re-examined and coded by all six team members. Quantitative Methods.
Stanny, C., et al., 2015	ACRL Standards	59.20%	Developed a rubric and used it to document SLOs and assignments on the syllabi and their alignment with the ACRL IL Standards. Rubric was normed using 110 syllabi randomly selected for training purposes. Conducted weekly calibration checks with coder pairs and inter-rater agreement (95%) was computed. Quantitative methods.
VanScoy, A., & Oakleaf, M.J., 2008	Mentioned ACRL IL Standards but not used in analysis	97%	Registrar provided a random sample (n=350) of first semester, freshman containing course information for each. Data were transferred to a relational database for analysis. Syllabi and assignment information were collected but complete data were collected for only 139. The full set of syllabi was analyzed to see if assignments required research tests and yes/no was entered into the database.
Willingham-McLain, L., 2011	IL Components from the Middle States Commission on Higher Education; Institutional Student Learning Outcomes	44%	Created question list from self-study questions list developed by University for accreditation. Created a random sample of syllabi containing 10% of courses in all departments. Solicited syllabi from department and received 68%. Developed a detailed coding sheet and then refined it to be more precise. Three researchers each coded one-third of the syllabi for answers to all the questions. IL was present if one or more of the IL indicators from the Middle States Commission on Higher Education were found. Random, stratified sample used; IRR was informally done.

calculated for Beouy and Boss (2019) using Cohen's kappa calculations; Krippendorf's alpha was used in studies by Boss and Drabinski (2014) and McGowan et al. (2016). McGowan et al. (2016) used a random sample of syllabi for norming with reviewers. Scores were assigned for the presence of IL tasks or concepts in syllabi: 0-4 (Smith et al., 2012; Lowry, 2012; McGowan et al., 2016).

In some studies, scales were used to assign scores to syllabi showing the extent of IL activity. Higher scores were associated with more demanding IL assignments (Smith et al., 2012; Lowry, 2012; McGowan et al., 2016). The Lauer rating scale gave long research papers/projects more weight than shorter assignments. The syllabi in Beouy and Boss (2019) were compared to the ACRL framework and each frame present in the syllabus was scored between 0-2, with an optimal IL score of 12 points for the syllabus. Other studies mapped syllabi to IL concepts in professional standards, such as AAC&U (Boss & Drabinski, 2014; Alcock & Rose, 2016); AACN Essentials, and the ACRL Standards for Nursing (Miller & Neyer, 2016). Institutional Student Learning Objectives were also used as tool for identifying IL concepts (Willingham-McClain, 2011; O'Hanlon, 2007).

For many papers, the syllabus studies highlighted classes that were missed by subject librarians or that provided opportunities for IL instruction (McGowan et al., 2016; Alcock & Rose, 2016; Beouy & Boss, 2019; Boss & Drabinski, 2014). The results of syllabus analysis gave librarians new and strategic information for approaching faculty and more opportunities for collaboration (Lowry, 2012; Boss & Drabinski, 2014; Beouy & Boss, 2019; Dewald, 2003).

Willingham-McLain (2011) and Dinkelman (2010) made recommendations for improving syllabi overall. Dinkleman specifically addressed ways to make library resources and

services clear to students. For science classes, names of discipline specific databases should be part of the syllabus and the subject librarian and library resources/services should be mentioned. Also, wording can be confusing and students may misinterpret directions. If the statement "Only 2 resources may be from the Internet" is in the syllabus, students may think a scholarly article from a dot com publisher is excluded (Dinkleman, 2010).

Tailoring IL instruction for different disciplines was described in several studies. Dinkleman (2010) noted the basics of science literacy and reading a scientific article were indicators for IL instruction. Alcock & Rose (2016) compared syllabi from Chemistry and History, and Maybee et al. (2015) compared syllabi from Nutrition Science and Political Science. Both studies noted very different SLOs and research development. Data literacy was included in the Maybee et al. (2015) review and they argue that data literacy is a component that should be included when measuring IL. Morris et al. (2014) looked at archival literacy as a specialized form of IL and examined syllabi for use of primary sources.

Maybee (2015) found that research assignments increased in syllabi in graduate studies across disciplines. Dubicki (2019) found more complex research required in upper level and graduate classes. Two studies included graduate and undergraduate syllabi in the same subjects. An increase in emphasis on the research process and data analysis in graduate courses was noted in Maybee et al. (2015). Beouy and Boss (2019) used the ACRL frames to identify increased opportunities for research and IL intervention in graduate courses. VanScoy and Oakleaf (2008) determined that tiered IL instruction may not be appropriate because their study of incoming freshman showed IL tasks in syllabi from the beginning. However, Dubicki (2019) argued strongly for scaffolding instruction and teaching IL on a novice to expert searcher path.

Table 4
Results and Recommendations of Studies Reviewed

Citation	Results
Alcock, E., & Rose, K., 2016	Comparison of the results revealed that Chemistry always lagged History. In History, 85% of the syllabi required independent research versus 39% of the Chemistry syllabi. Cumulative projects were required on 72% of the History syllabi versus 8% of the Chemistry syllabi.
Beuoy, M., & Boss, K., 2019	Analysis of the IL presence scores showed in all but one frame, the average score for all disciplines was less than 1. Food science had the highest average scores in five of the six frames. Media, Culture and Communication's average score was the highest in one frame (Information has value.)
Boss, K., & Drabinski, E., 2014	The data showed that 53% of syllabi required business students to use library resources independently while 64% of syllabi required a cumulative project.
Dewald, N., 2003	Analysis showed that in 2001-2002, 48% of all business classes reviewed did not require library use or research. Significant research projects during the same period were found in only 18.3% of the business classes.
Dinkelman, A. L., 2010	Found that only 18% (average) of the syllabi with IL assignments mentioned the library as a resource and that only 10% (average) of the classes required a research paper/project. Recommended a required library course for students
Dubicki, E., 2019	Addressed need to tailor IL instruction for specific disciplines; Found that tiered IL instruction is important for a student's development.
Jeffery, K. M., et al., 2017	No mention of library related services or spaces or research assignments was found in 54% of the syllabi. The most popular keyword codes were Research paper, APA, and MLA.
Lowry, L. 2012	Syllabi covered 100% of accounting classes during study period and found that only 8 of 66 courses (12%; all at the senior level) required outside research or significant research. Author suggests that problem-based learning is a good way for students to acquire information competence.
Maybee, C., et al., 2015	Major themes identified in Political Science were: Research Inquiry at the undergrad level and Research Process and Critical Awareness of Aspects of Political Science Research at the grad level. In Nutrition Science, the major themes identified included Professional Identity and Scientific Practice (undergraduate) and Engaging as a Scholar including information and data literacy (graduate).
McGowan, B., et al.,2016	Inclusion of any ACRL IL Standard by course varied from 53.8% at the Junior level to 65% at the Senior level and averaged 58.8%. Research paper or literature review without data collection varied from 19.6% (Sophomores) to 33.1% (Freshman). Empirical research papers varied from 1.6% of assignments for Sophomores to 3.8% for Juniors.
Miller, M., & Neyer, L., 2016	Discussed IL instruction scaffolding within nursing and the importance of tiered IL instruction. Analysis showed that IL outcomes in assignments were explicit 84% of the time.
Morris, S., et al., 2014	Began development of a list of archival literacy competencies.
O'Hanlon, N. 2007	48% of all syllabi analyzed did not contain any research-related SLOs. 59% of syllabi described a writing assignment requiring external research.

Smith, C., et al., 2012	Hypothesis that library research would be required by the majority of classes. The findings did support the hypotheses that the amount and degree of research required would vary by course level and that the amount of research would also vary by subject discipline.
Stanny, C., et al., 2015	More than half of the syllabi (58.5%) had one or more course SLO that aligned with IL outcomes. Alignment of assignments with IL outcomes was observed in 59.2% of syllabi. Online classes described few assignments related to IL concepts and the most common assignment was not an IL assignment. In both online (17%) and face-to-face classes (27%), literature reviews were the most common IL assignment.
VanScoy, A., & Oakleaf, M. J., 2008	Recommended a re-examination of earlier tiered IL instruction recommendations; analysis showed that 97% of the 350 students had assignments that required the use of research resources. For the subset of 139 students, 100% had assignments requiring them to find research resources with the most common being (in rank order) articles, websites, and books for both groups.
Willingham-McLain, L., 2011	Found that 44% of syllabi incorporated any of the Middle States Commission IL indicators.

Limitations Identified by Study Authors

Several limitations were noted by authors of the syllabus studies. Standardized templates for a syllabus can skew results of a syllabus analysis. If the library is mentioned in a syllabus, and that is used as an indicator of IL in the course, the researcher needs to know if it is referring to a building, resources, or services (Alcock & Rose, 2016). "Template language and template syllabi can also yield less robust data, as they are a shell for the course" (Beouy & Boss, 2019; Boss & Drabinski, 2014). A lack of a thorough norming process for interrater reliability (Boss & Drabinski, 2014) and the small number of syllabi in sample sets (Alcock & Rose, 2016; Dubicki, 2019) were limitations in some study designs. Finally, SLOs and learning goals can be unique to an institution or department, so generalization of results to other campuses is not possible (Dubicki, 2019).

Discussion

The questions posed for this scoping review asked how syllabus studies were used to inform IL instruction, what methods were used to analyze syllabi, and what recommendations were suggested by researchers for IL instruction. Seven themes were identified in this scoping review.

Universally, Syllabus Examination Gave Librarians Better Insight into Collaboration with Faculty and Student Instruction

All studies tried to determine the expectations of instructors for IL concepts and tasks through syllabus examination. Some found opportunities identified by syllabi to offer IL instruction to faculty; others gained an understanding of scaffolding instruction; and others identified specific courses that would benefit from librarian intervention. Several studies reported better collaboration with faculty because of the information derived from the syllabus study.

"What emerged were indicators of potential student needs as they conduct research projects, leading to a roadmap of the topics that librarians should include during IL instruction at various levels of students' academic careers, as well as services the library can develop to support students' independent study." (Dubicki, 2019, p. 291)

"Rather than approaching faculty and administration with the assertion that librarians can add value to their program, the gathered data provide evidence for this claim, as librarians make the case for institutional collaboration and the need for increased resources for the information literacy program." (Boss & Drabinski, 2014, p. 274)

Disciplines Vary in Kinds of IL Instruction Needed

Differences in IL requirements for subjects were illustrated by comparisons between history and chemistry, and food science and political science. Several studies approached IL with specialized concepts: primary sources, scientific literature, data literacy. Also recognized were the range of research assignments that are specific to disciplines: lab reports or field work for the sciences compared to literature reviews or annotated bibliographies for the social sciences and arts & humanities.

"Although students are taught basic information regarding research skills and library resources in English composition courses and the required library course, the continued development of these skills, especially as they relate to the discipline, is crucial to their success in college and beyond." (Dinkleman, 2010, n.p.)

Numerical Scales Preferred

The methods used reflected different indicators of IL. Scales scoring the presence of assignments that would benefit from IL instruction were used most widely. Library usage (reserve readings, outside readings) was used as an indicator of IL content on some measurements. Other studies looked for IL concepts identified in ACRL standards or framework (for example, critical thinking). Standards from educational organizations (AAC&U) or professional associations (AACN), were also used to identify IL concepts.

IL Reflects Changes Over Time

IL instruction has evolved over time, with more emphasis placed on concepts vs tasks. In 2008, VanScoy and Oakleaf showed that tasks like "Find a book" or "Find an article" were required from the beginning coursework, leading them to conclude that freshman need the same IL skills as students in advanced classes. Eight years later, the ACRL Framework for IL (2016) addressed threshold learning and skill mastery as a student progresses through courses. The assumption is that basic IL concepts are taught in undergraduate core classes and advanced research concepts are mastered at higher academic levels. Dubicki's study (2019) argued strongly for building on IL instruction through course progression. The conflict between these 2 papers, published 11 years apart, are a reflection of changing views on IL instruction.

"This research study revealed that a tiered approach can be used effectively to provide library instruction as students move along the continuum from novice to expert researchers." (Dubicki, 2019, p. 296)
"The study results suggest that many early recommendations regarding tiered instructional approaches should be reexamined." (Vanscoy & Oakleaf, 2008, p. 572)

Mismatch Between Librarian Involvement and IL Indicators Found in Syllabi

All studies found elements of Information Literacy in the syllabus. Some studies found IL was defined in terms of tasks or activities (find peer-reviewed articles); other studies found IL was identified by concepts (plagiarism, critical appraisal of articles) that aligned with Student Learning Objectives of the instructor and institution.

The studies that compared IL mentioned in syllabi to librarian involvement in classes showed that librarians were not providing IL instruction or librarian presence in a large

percentage of courses. Results from Jeffrey et al., 2017, detailed an 18% gap between library instruction and research assignments in syllabi. Several possible reasons were posited by authors: instructors assume students have IL competence; are unaware of librarian IL instruction or contributions; or instructors don't have time in the course to use librarian services. Smith et al. (2012) and Alcock and Rose, (2016) found examples that showed faculty are teaching IL in courses.

 "In the absence of library instruction, 34% of the courses suggested that the professors were taking on a type of library instruction to ensure that students had the skills to successfully complete." (Alcock & Rose, 2016, p. 92)

Methodology for Studies Was Often Unclear

The methodologies used by the different researchers varied and frequently did not provide key details. The number of syllabi used was not always reported. The use of specific scoring tools was reported, but studies using question checklists, searching of keyword lists developed for the study or other methods of analysis were not described sufficiently. However, one study (Maybee et al., 2015) used a grounded theory research design, clearly outlined, resulting in a comprehensive examination of differences between political science and nutrition studies at the undergraduate and graduate level. The use of this research design allowed researchers to analyze in depth the IL requirements at different stages of curriculum.

Studies Are Replicable but Results Are Not Generalizable

Although some studies tried to compare results to other published studies, the numerous and inconsistent variables make that difficult to accomplish. Too many variables (SLOs unique to campus, syllabi templates, individual instructors, unique content, number of syllabi,

discipline differences) in these studies make the results unique to a campus, instructor, or discipline and not generalizable.
"Although this project may provide insights on how the Framework concepts can be infused into IL instruction, the results are unique to the XX curriculum." (Dubicki, 2019, p. 296)

However, the methods of syllabi mining used in these studies are easily replicable and do offer liaison librarians strategic ways to connect to instructors and the curriculum.

Limitations

This scoping review includes several limitations. The searches executed excluded grey literature and did not consider poster presentations and conference proceedings. Two reviewers charted data independently, but a third reviewer would have helped to limit bias and make decisions on inclusion and exclusion questions. The multidisciplinary database, Web of Science, was used because the authors had access, but other large databases should be considered.

Conclusions

The results of this scoping review show IL concepts and assignments are present in approximately half of syllabi examined in these studies. The presence of IL competencies in syllabi was more dependent on discipline (arts and humanities vs science) than on class standing (lower vs upper or graduate vs undergraduate). Librarian researchers used syllabi studies to examine what kinds of IL instruction are needed by students to complete coursework successfully.

The early methods for assessing syllabi for IL content looked for any mention of library use, but with the promotion of ACRL standards and more recently the IL Framework, the evaluation of what concepts and assignments meet the criteria for IL is better identified. This provides a structure and continuity to the research that will

be easier to replicate and interpret. Converting the IL framework into rubrics or checklists is the method used in many of the existing studies, and provides a blueprint for future research.

IL standards from professional associations were central to many studies, and further research aligning ACRL frames, discipline standards and course syllabi will help to integrate instruction. Three articles mentioned data literacy, which is becoming central to a scholar's education in the increasingly networked research world (Shorish, 2015). More research on inclusion of data literacy as part of IL instruction, and as it is reflected in course syllabi, is warranted.

Even though the results of a syllabus study are not generalizable, the methods can be consistent and provide valuable information to an IL program. Overwhelmingly, the studies provided recommendations for using a syllabus study for better collaboration with instructors. The information derived from these studies present talking points to use with instructors and allow the IL instruction to be relevant and targeted at the point of need of the student.

Liaison librarians should be encouraged to conduct syllabus studies to increase collaboration with instructional faculty, to meet student information needs in a strategic manner, and to identify discipline-specific Information Literacy concepts.

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Appendix
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