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"It's in the Syllabus": Identifying Information Literacy and Data Information Literacy Opportunities Using a Grounded Theory Approach

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Abstract

Developing innovative library services requires a real world understanding of faculty members' desired curricular goals. This study aimed to develop a comprehensive and deeper understanding of Purdue's nutrition science and political science faculties' expectations for student learning related to information and data information literacies. Course syllabi were examined using grounded theory techniques that allowed us to identify how faculty were addressing information and data information literacies in their courses, but it also enabled us to understand the interconnectedness of these literacies to other departmental intentions for student learning, such as developing a professional identity or learning to conduct original research. The holistic understanding developed through this research provides the necessary information for designing and suggesting information literacy and data information literacy services to departmental faculty in ways supportive of curricular learning outcomes.

Introduction

Academic libraries have launched multiple initiatives addressing the 21st century teaching, learning and research needs of faculty, administration and students. Developing innovative library services requires a real world understanding of both the desired goals of faculty, and current practices in the lab and classroom. While the ties we develop with these groups may inform the development of strategic directions, many values and goals are implicit to members of a department and may not be readily accessible to librarians. In this project we aimed to develop a comprehensive and deeper understanding of faculty expectations for student learning related to information and data information literacies. We used *grounded theory,* an approach by which new understandings are derived through an inductive analysis of original data (Glaser & Strauss, 1967), in this case course syllabi. Course syllabi represent a useful artifact of study as they articulate learning goals, expectations, and desired outcomes, details on assignments and often the rubric by which students will be evaluated. The depth of the analysis afforded by using grounded theory techniques not only allowed us to identify how faculty were addressing information and data information literacies in their courses, but also enabled us to understand the interconnectedness of these literacies to other departmental intentions for student learning, such as developing a professional identity or learning to conduct original research. Advancing the Purdue Libraries' information literacy and data services initiatives, the deeper understanding resulting from our grounded theory approach will enable the liaison librarians involved in this project to craft targeted responses aligning with the learning goals of departments and key faculty.

Literature review

A syllabus is typically considered an expression of an instructor's intentions for learning in a course. Collectively, syllabi for a specific program may represent a departmental faculty's curricular aims for student learning. Research activities and practices have been associated with disciplinary classifications: hard pure (e.g., physics, biology) hard applied (e.g., engineering, medicine), soft pure (e.g., history, sociology) and soft applied (e.g., marketing, communications) (Biglan, 1973a, 1973b). While earlier studies about disciplinary cultures focused on scholarship, teaching practices also vary in ways aligning with Biglan's classifications (Lattuca & Stark, 1994; Neumann, 2001). This includes information literacy teaching practices. In a study of how information literacy is experienced by higher education academics, faculty from disciplines associated with each of the Biglan classifications were interviewed (Webber, Boon, & Johnston, 2005). Initial results suggested that faculty who teach marketing may view information literacy as integral to becoming an independent marketing professional, while faculty teaching English tend to separate information literacy from disciplinary learning. Disciplinary culture has been found to be the key driver in curriculum development, with institution-wide and external concerns having less direct influence (Stark, Lowther, Bentley, & Martens, 1990).

If syllabi should represent disciplinary cultures and reveal the aims and values of the instructor, librarians may use them to gain a better understanding of how to structure library services to connect with faculty and students more effectively. Sayles (1985) recognized the power of syllabi analysis for informing library interests, referred to syllabi as a "gold mine of information" to aid librarians in their support of teaching. Rambler (1982) attributed as being the first to conduct syllabi analysis research, analyzed 162 randomly sampled syllabi from one semester of courses at a large public institution to determine library usage. This research opened a pathway for numerous studies analyzing syllabi, which primarily focused on determining how library resources are used in coursework (Dewald, 2003; Lauer, Merz, Craig, 1989; Sayles, 1985; Smith, Doversberger, Jones, Ladwig, Parker, & Pietraszewski, 2012; Williams, Cody, & Parnell, 2004).These studies typically used similar frameworks to examine library-related concerns, such as the use of reserve services or reading materials not on reserve and the extent of library research.

More recent syllabi analysis studies have focused on information literacy (Boss & Drabinski, 2014; Dinkleman, 2010; O'Hanlon, 2007; VanScoy & Oakleaf, 2008). In general, these studies focused on a specific program, although VanScoy and Oakleaf (2008) used syllabi analysis to explore information literacy outcomes and coursework in courses taken by students during in their first semester. As outlined in Table 1, this body of research identified learning outcomes and assignments related to information literacy. Reflective of libraries' evolving need to become more directly involved in curriculum, these studies expand the aim of syllabi analysis beyond determining how library resources are utilized. This research identified what students were expected to do in their coursework in order to develop responsive library support that may include efforts to expand a curriculum to focus more on information literacy.

Table 1: Syllabi analysis studies focused on information literacy (IL)

	Curricular scope	Data	Focus
Dinkleman (2010)	Biology program	104 syllabi	IL learning outcomes and assignments, use of external sources and scientific literature, citation style, and library use.
VanScoy and Oakleaf (2008)	First semester students	Available syllabi for courses taken by 350 students during their first semester	Research tasks required of first-semester students.
O'Hanlon (2007)	General education	71 syllabi	Research skills in learning outcomes and

			assignments, types of information resources required and IL instruction.
Boss and Drabinski (2014)	Business program	79 syllabi	IL and librarian use in School of Business courses.

With the advent of government funding agencies, the National Science Foundation in particular, requiring researchers to develop and submit data management plans with their grant applications, academic libraries are seeing opportunities to apply their expertise in organizing, describing, disseminating and preserving information towards research data (Tenopir, Sandusky, Allard and Birch, 2014). More recently librarians are expanding their instructional scope to address researchers' needs in producing data sets (Coates, 2014). Researchers are increasingly being asked to manage their data in ways enabling others to discover, understand and use the data for their own purposes and to ensure its longevity beyond the project or purpose it was originally created for. However, many research fields lack established norms and practices in managing, sharing and preserving their data, making it difficult for researchers to respond to these pressures effectively. Recognizing a need, many librarians are developing "data information literacy" programs to raise awareness amongst researchers and help students improve their practices in working with research data (Carlson & Johnston, 2015; Peters & Vaughn, 2014). Data information literacy is distinguished from data literacy, which emphasizes interpreting, analyzing and other aspects of consuming data. In contrast, data information literacy focuses on the production of research data as well as its consumption. It centers on the treatment of data as objects of scholarly value in and of themselves, necessitating deliberation and action towards their management, dissemination and preservation to ensure their fitness for discovery and use beyond their original purpose (Carlson, Fosmire, Miller, & Sapp Nelson, 2011). Developing an effective data information literacy program can be challenging as it is often difficult to identify potential needs of students and to align programmatic responses with existing cultures of practice. We anticipated that a critical analysis of syllabi could facilitate a better understanding of faculty expectations for their students regarding working with research data, which in turn could be used to inform data services and data information literacy programs specifically offered by the library.

Methodology

Our research takes a different approach to analyzing syllabi than earlier studies. One difference is that we examined syllabi for data information literacy and information literacy indicators. More importantly, we first identified overall themes in the syllabi, including information and data information literacies and then determined how these themes related to one another to develop a comprehensive understanding of curricular aims. This approach not only helped us acquire a richer understanding of an individual instructor's intent and needs for a class, but also enabled us to see connections and relationships between each class and the corresponding departmental intent and needs. This understanding positioned us to reach out to these departments and engage them in more meaningful ways.

In this study we asked, "How are information and data information literacies addressed in discipline-specific curricula?" As with earlier syllabi analysis research, we selected departmental curricula at Purdue University to investigate and then collected all available syllabi for those courses. To the degree possible, we wanted to understand information and data information literacies from the perspective of the faculty members who developed the curricula. Therefore, we rejected research approaches in which the analysis relied on an existing information or data information literacy framework to explain the findings. *Grounded theory* was adapted to guide our data analysis. Developed by Glaser and Strauss (1967), grounded theory is an inductive methodology by which theory is typically discovered through an analysis of original data. Although our aim was not generating a theory, the methods used in grounded theory research enabled us to reveal faculties' curricular intentions for information and data information literacies.

Selecting departments and collecting syllabi

The departments of nutrition science and political science at Purdue University were selected for this study for two reasons. First, the library subject liaisons involved in the project had a strong interest in exploring how information and data information literacies were addressed in these curricula. Second, we wanted to explore disciplinary differences related to how information literacy and data information literacy were addressed through coursework. As exemplified by the two departments chosen for this study, departments may have widely varied practices regarding syllabi sharing. The Purdue nutrition science program shares syllabi via the departmental website, which is updated each semester. Although the syllabi are available with open access, we informed nutrition science faculty members about the study and offered them the option to have their syllabus excluded. By contrast, the political science department did not make syllabi publicly available. In this case, the department chair sent us copies of the syllabi electronically after giving faculty the option to have their syllabi excluded. In both cases, no one requested exclusion. We received 42 syllabi from nutrition science, representing over 75% of the nutrition science courses taught during 2012-2013, and 46 syllabi from political science, representing over 60% of the political science courses that were taught during this period. The syllabi we collected included the required courses for the major. The nutrition science sample was comprised 29 undergraduate and 13 graduate syllabi. The political science sample was comprised of 39 undergraduate and 7 graduate syllabi.

Analysis procedures

We formed two sub-teams for the analysis, one focusing on nutrition science and the other on political science. Each team was comprised of three people, an information literacy specialist, a data specialist and a liaison librarian for the subject area. The teams engaged in analysis procedures adapted from the methods typically used to conduct grounded theory research. Birks and Mills (2011) outlined key elements of grounded theory research, which begins with initial coding of phrases drawn verbatim from the data. The resulting codes are grouped into categories, which are constantly compared: codes to codes, codes to categories, and categories to categories. Memos are written to capture researchers' thinking as it evolves throughout the investigation. Fully developed categories are formed during an intermediate coding phase in which categories or subcategories may be merged. Resulting in an "integrated and comprehensive grounded theory," the last phase of analysis may draw concepts from other theories to further explain the phenomenon under study. The three phases of analysis adopted for our project were iterative; the processes associated with each phase were revisited several times throughout the analysis process:

1) **Syllabi familiarization and initial coding -** All members of each team read through the syllabi to familiarize themselves with their content and then assigned initial codes that were drawn directly from the syllabi text. The members of the two research teams met several times and through discussion, came to consensus on the initial coding.
2) **Intermediate coding -** The team members reviewed the syllabi again and each team confirmed, or continued to discuss, the coding of the individual syllabi. At this point, the teams identified the relationships between the syllabi. Codes were then grouped into categories and memos were written describing each category. Reflecting on the memos, each category was discussed by the responsible team, resulting in subcategories being merged into overarching categories. This process continued until consensus on the formation of the categories was reached by each team.
3) **Theme generation -** The categories were reviewed by the teams and themes were identified that described aspects of the undergraduate and graduate curricula developed by the nutrition science and political science departments at Purdue.

Findings

Undergraduate syllabi

In this section, the major themes emerging from the analysis of the syllabi from each undergraduate curriculum are described. Nutrition science strongly emphasized developing a *professional identity*, although a handful of courses focused on *practicing science,* which provides a pathway for those interested in becoming nutrition science researchers. The political science curriculum emphasized *building a foundation* in aspects of political science, such as basic intellectual infrastructure of public policy, international relations and law. A second theme identified in our analysis of political science syllabi is the notion of *research inquiry,* focusing on learning about the theories and methods used by political science researchers.

The analysis revealed that information and data information literacies were also addressed differently in the two curricula (see Table 2). In nutrition science, information literacy, and to a lesser extent data information literacy, activities were a part of *professional identity*. Both were part of *practicing science* as well, although within this theme, there is more focus on data information literacy activities. By contrast, in the political science curriculum, data information literacy activities were associated closely with *research inquiry*, while information literacy was focused on primarily as part of *building a foundation*.

Table 2: Data information literacy and information literacy at the undergraduate level

	Nutrition Science		Political Science	
	Professional identity	Scientific practice	Building a foundation	Research inquiry
Data-related activities	Analyze federal and state health data Evaluate and interpret client data Conduct analysis of secondary data Analyze and interpret nutritional content of menus and labels Interpret financial data Document interactions with clients	Record observations Conduct surveys and interviews with clients Evaluate data for decision making purposes Prepare lab reports	Compare conclusions drawn from analyzing global data to existing theories	Understand data collection, description, and analysis Use statistical software Replicate existing study Independent research project
Data sources	Food labels Field and client data Federal and state health data Nutritional data	Original data	Global data	Original data Existing study data

Information literacy-related activities	Evaluate information Research a health issue encountered in practicum Develop educational or promotional materials	Identify evidence supporting claims in scholarly articles Search, evaluate and interpret information Prepare review article Debate scientific controversies Become familiar with emerging scholarship	Read critically Interpret legal materials Write briefs Stay up-to-date on current events Use research evidence to inform class discussion Find and interpreting information	Write literature review
Information sources	Scholarly literature Standards Dietary guidelines	Scholarly literature	Scholarly literature Popular media Legal documents Policy documents	Scholarly literature

Nutrition Science Undergraduate Curriculum

The research team examined 29 undergraduate course syllabi from nutrition science. Twenty-four courses represented by the syllabi focused on *professional identity*. *Scientific practice* was the focus of 4 courses, while one course addressed both.

Theme: Professional identity
The theme of *professional identity* was a major emphasis of the undergraduate nutrition science curriculum. *Professional identity had* a strong clinical or applied focus on professional practices, as well as client and community communication. These courses aimed to connect students to bodies of scholarly literature, professional organization and community standards. Several of the syllabi had an explicit goal of preparing students to assume professional positions in the field. Exemplifying the professional focus of the curriculum, the syllabus for a 400-level practicum experience described the course as enabling students to learn or practice several client-related activities:

> ...sharpen your nutrition and fitness assessment skills, interpret assessment data, set goals and objectives with clients, design and implement individualized nutrition and fitness programs, counsel clients on a regular basis, incorporate behavioral strategies, follow clients' progress, evaluate the effectiveness of the nutrition and fitness programs you designed and implemented, document all interactions with clients, and discuss with your classmates the successes and barriers you experience with your client. (NUTR 415, Fall 2012)

Some of the courses focused on acquiring credentials, such as a food safety certification course that prepares students to pass professional certifications. Several courses emphasized professional communication. An upper-level public health course required students to practice communicating in ways that focus on taking action, such as writing a letter to a policy maker or funder, or developing a strategic plan promoting nutritional health. Frequently involving a practicum experience, several of the syllabi had an explicit goal of preparing students to assume professional positions in the field.

Using data as related to various professional practices was primarily identified in syllabi for upper-level courses. This may suggest that working with data is considered advanced for undergraduate students. The syllabi reflected a variety of data information literacy-related activities. A 300-level course on dietary guidance required students to interpret data through reading food labels and associating certain foods or ingredients with health risks. In 400-level practicums, students were asked to collect field data or client data for evaluative purposes with clients. An example of an information literacy activity related to *professional identity* occurred in the practicum course, which had students explore a topic related to their practice site using state and federal health information resources, such as the Agricultural Research Service's Community Nutrition Mapping Project. In addition to a course that has students develop educational or promotional materials to disseminate at health fairs, information literacy was also an aspect of courses that emphasize communication with other healthcare professionals or clients.

Theme: Scientific practice

While only a major focus in 4 courses, *scientific practice* still emerged as an important nutrition science curriculum focus. *Scientific practice* drew together several elements, including evaluating scientific research quality, debating scientific controversies, and becoming familiar with emerging nutritional research. For example, one introductory course required students attend two or more campus lectures to evaluate the quality of the "science" presented. Scientific practice was a major focus of two 400-level courses, including a special topics course that emphasized critically evaluating emerging research and specifically explaining the controversies taking place in the field.

In comparison to courses focused on *professional identity*, nutrition science courses that emphasized *scientific practice* included more information literacy-related activities. Data information literacy-related activities focused primarily on data collection. A 300-level study abroad course had students record their observations of eating and dietary patterns of people in France while studying there, and a 400-level communication course assigned students to conduct surveys and interviews with clients. Information literacy activities related to scientific practice began early in the curriculum. The syllabus for an introductory course first required students to identify evidence that supported claims made in scholarly articles they were reading, and later to independently seek out evidence to answer their own questions. A 200-level honors course was co-taught by a Libraries' faculty member, who facilitated several sessions devoted to searching for and evaluating information. As with *professional identity*, information literacy was also associated with communication, a sub-theme identified as part of courses focused on practicing science. A 400-level special topics course required students to search for, evaluate and interpret scholarly literature to prepare a review of an emerging topic using the Author Guidelines (2014) from *Nutrition Reviews*, a peer-reviewed journal in the field.

Political Science Undergraduate Curriculum

The research team examined 39 undergraduate course syllabi from the political science department. Thirty-two of these courses focused on a broad theme of *building a foundation*. Several sub-themes emerged from within the *building a foundation* theme that focused on developing different ways of thinking, such as political, legal or policy thinking, as a major emphasis in some of those courses. Aligning with the curricular theme of *research inquiry*, 7 courses represented by the syllabi had a strong focus on the theory and research methods used in political science.

Theme: Building a foundation

Building a foundation was a theme throughout the political science undergraduate curriculum. Introductory courses provided entry points into the 5 tracks of the political science curriculum: American politics, comparative politics, international relations, political theory and methodology and public policy. A major emphasis of *building a foundation* was on understanding how political scientists use theories and methodologies to interpret political issues. For example, the description for an introductory environmental policy course emphasized how theory would be used to explore sustainability issues:

This course focuses both on domestic and international environmental policy with special attention given to the role ideas, interests, and institutions play in the policymaking process; specifically with regard to how each can lead to ineffective environmental policies. Emphasis is placed on discussing traditional environmental theories as well as visionary alternatives for creating policies that promote a sustainable environment and provide ways to overcome the obstacles posed by ideas, interests, and institutions. (POL 223, Spring 2013)

At the upper level, courses typically focused on specific aspects of an educational track in which students would take courses related a specific topic, such as international human rights or U.S. foreign policy. Although not an official track, aspects of law, such as women and law or environmental law, was the focus in four of the upper-level courses we examined.

Various *ways of thinking* emerged as an important sub-theme of *building a foundation* that emphasized approaches students may have adopted to explore and analyze aspects of political science. Critical thinking or related terms, such as critical reading or reflecting, were found in 16 syllabi, although typically these terms were not well defined. Thirteen of the syllabi we examined emphasized types of thinking, such as political science thinking, legal thinking and policy thinking, which suggested specific approaches to engaging with course materials:

- Political science thinking focused on the political scientists' conceptual tools, such as using an analytical framework that views politics as a struggle over who in society gets power and resources.
- Legal thinking involved reading and interpreting legal materials, such as court opinions, and statutory provisions, often to prepare students to write briefs.
- Policy thinking focused on the application of public policy and administration theories and models to develop policy perspectives and analyze and suggest solutions for public problems.

Information literacy-related activities were present in several of the syllabi associated with *building a foundation* in political science. Seven of the syllabi we analyzed asked students to stay up-to-date on current events, typically through reading a national newspaper. In addition to staying informed, this requirement focused on enabling the students to apply what they had learned, a theory, tool or other resource, to a particular news item in order to gain a better understanding of how a political scientist interprets political issues. The syllabi offered a range of approaches for finding information, which included directing students to a general resource (e.g., JSTOR), or to a discipline-specific resource (e.g., American National Election Studies). Two syllabi stressed drawing conclusions from research findings. One example of this was a 100-level American government course that required students to draw from the literature to inform their posts to the class discussion board and also suggested bringing in outside sources to support their analysis when responding to posts with which they disagreed. The analysis revealed very little attention to data information literacy activities.

Theme: Research Inquiry

Research inquiry was a major theme of the political science undergraduate curriculum. Data information literacy was a significant part of these courses, drawing together several research-related concepts. These included applying theory as well as understanding the research methods used in political science, including ways of collecting and analyzing data. Students in political science courses may encounter aspects of *research inquiry* in some lower-level courses, but all political science majors are required to take a 300-level research methods course. While introducing the research process in a comprehensive way, this course focused specifically on data collection, identifying human subjects, data description, data analysis, and learning to use statistical software. A number of 400-level courses also focused on research processes including data collection and analysis. From the syllabi making up our sample, a 400-level politics of food course required students to take field notes when visiting grocery stores, while a

legislative internship offered students an opportunity to complete an independent research project. As a capstone to the political science undergraduate curriculum, students may choose from five course options, including a senior seminar, and an undergraduate research experience. The senior seminars focused on select topics, such as terrorism and the media, or power dynamics in the Horn of Africa, although techniques for data collection and analysis were covered in these courses as well. The research experience course, which focused on public opinion research, required students to replicate the findings of an existing study. Although only one syllabus listed activities where students were to learn about conducting a literature review, nearly all of the courses that focused on *research inquiry* required a literature review, typically as part of a research plan.

Graduate Syllabi

In this section, the major themes emerging from the analysis of the graduate syllabi from each curriculum are described. Nutrition science emphasized interacting and communicating as part of *engaging as a scholar*. By contrast, the political science curriculum strongly emphasized learning a *research process* to guide in conducting original research, as well as developing a *critical awareness* when engaging with and communicating about political science scholarship. As with the undergraduate curricula, the analysis revealed that information and data information literacies were addressed differently in the two graduate curricula (see Table 3). In nutrition science, information literacy, and to a lesser extent data information literacy, activities were a part of *engaging as a scholar*. By contrast, in the political science curriculum, data information literacy was associated closely with *research process*, while information literacy was focused on primarily as part of *critical awareness*.

Table 3: Data information literacy and information literacy at the graduate level

	Nutrition Science	Political Science	
	Engaging as a scholar	Research process	Critical awareness
Data-related activities	Data visualization (academic poster) Present seminar on individual research	Replicate previous research in a way that extends the original Conduct original research Data collection, documentation, description, and analysis	Identify data to address research question
Data sources	Original data	Original data Existing study data	
IL-related activities	Summarize and critique articles Find, evaluate and debate scholarly literature Technical writing and documentation		Lead class discussion and debate of scholarly materials Prepare reports on assigned readings Evaluate, summarize and analyze information
Information sources	Scholarly literature		Scholarly literature

Nutrition Science Graduate Curriculum

Sixteen graduate-level syllabi were examined from nutrition science. Our analysis revealed that all 13 courses represented by the syllabi aligned with some or all of the aspects identified in the curricular theme of *engaging as a scholar*. *Engaging as a scholar* included two sub-themes, *communication* and the *critical use of evidence*.

Theme: Engaging as a scholar

In contrast to the undergraduate program, which was primarily focused on preparing practicing dietitians, the graduate program supported students in becoming scientific researchers. The curriculum was not aimed at teaching students to conduct research, but on engaging and communicating as scholars. This is exemplified in the goals described in the syllabus for a seminar course:

> A successful career in nutrition will require that you be able to evaluate scientific research and then communicate that information effectively to other nutrition researchers and health professionals. To do this you must be able to understand and organize information and you will then have to present that information in an interesting way. (NUTR 694, Spring 2012)

Scholarly practices were focused on early in the graduate curriculum, requiring students to engage with and communicate through the use of the nutrition science literature. Opportunities for students to apply what they had learned were increasingly provided near the completion of the program. This included interacting with scholars in the field. For example, in a special topics course on ingestive behavior students escorted and dined visiting scholars. In a capstone seminar, students prepared and delivered a 40 minute presentation of their research delivered in an open forum.

Information and data information literacies were associated with *communication* and the *critical use of evidence*, two sub-themes related to *engaging as a scholar*. Identified in 11graduate syllabi, the types of communication included peer and oral communication, debate, leading discussion, visualization, and written communication (technical and documentation). In preparing students for future roles as instructors, 4 courses also provided students with opportunities to lead classroom discussions. Data information literacy was only addressed in a seminar, preceding the capstone seminar, which required data visualization in the completion of a scientific poster assignment. Information literacy was emphasized throughout the curriculum. A strong emphasis was placed on using and evaluating information to understand specialized topics in nutrition science. Often this was associated with written or oral communication. This emphasis was exemplified by a 600-level series of three courses focusing on nutritional biochemistry and physiology, all emphasizing different aspects of scholarly identity. The first course required students to summarize and critique scholarly manuscripts, while in the second students wrote reviews aimed at evaluating research. In the third course, the students debated the best ways to decrease heart disease. Based on the syllabi we examined, as students advance through the curriculum they shift from consuming evidence to questioning it with a critical eye.

Political Science Graduate Curriculum

The research team examined 7 graduate course syllabi from the political science curriculum. Three of these courses focused primarily some aspect of a *research process*. Aligning with the curricular theme of *critical awareness of aspects of political science research,* 4 courses represented by the syllabi have a strong focus on understanding the theory and research methods used in political science. While the *research process* theme may appear similar to the *research inquiry* theme identified in the political science undergraduate syllabi, this category is qualitatively different. The undergraduate curriculum was focused on understanding aspects of political science research. As may be expected, the graduate syllabi shifted to emphasize conducting research.

Theme: Research process

The analysis of syllabi representing the political science graduate curriculum revealed a major emphasis on having students move from learning about research to becoming researchers. In contrast to the nutrition science graduate curriculum, which emphasized communicating research, the political science curriculum focused on conducting research. A 500-level introductory course served as the foundation introducing students to the political science *research process*. Later courses focused on research methods and built upon the research process outlined in the introductory course. Some of these courses centered on a particular topic or school of thought, but also discussed research processes appropriate to the subject matter.

Information and data information literacies were a large part of the introductory research methods course. In this course, students learned about an array of ways of working with data, including: collection, documentation, description, analysis and working with existing data. The students also engaged with the research literature in an assignment that had them evaluate research quality in three articles selected from a list of key journals in the field. Data analysis techniques were also the focus of two 600-level courses. In a 600-level course focused on the fundamentals of linear models, such as regression-based modeling, students analyzed data provided by the professor as well as replicating the data analysis in previously published works. Stating an expectation of publishable quality research, the trajectory from learning about research to conducting it was continued with a public opinion and electoral behavior course, in which students choose between the project of replicating previous research in a way which extends the original, or conducting original research.

Theme: Critical awareness of aspects of political science research

The syllabi for the graduate-level seminar courses we reviewed emphasized adopting a critical stance when engaging with and communicating about political science research. Similar to the undergraduate curriculum, the analysis of the graduate syllabi also indicated a focus on developing a foundation. However, at the graduate level this meant developing a thorough understanding of the theoretical concerns and the implications of different methodological approaches used to investigate select areas in political science. This was exemplified in an international relations course introducing students to theoretical and empirical work from a wide variety of perspectives, including: realism, liberalism, Marxism, feminism, and constructivism. In some courses, the notion of being critical was closely associated with understanding discipline-specific concerns. In the public opinion and electoral behavior course, evaluating research practices was focused on determining whether some public opinion attitudes are more stable than others, what causes attitudes to change and to what degree change is due to unreliability in its measurement.

Information literacy supported *critical awareness* primarily through activities that had the students summarize and evaluate political science research literature. This occurred through personal exchanges, such as in a 600-level international relations course where discussion leaders guided their fellow students in debates grounded in course readings. In other graduate courses, students critically reviewed political science literature through writing, such as a feminist theory and methodology course that required students to prepare reports on assigned readings summarizing the author's key arguments and describing how the article contributes to feminist theory. In a comparative politics course students wrote reviews analyzing the literature to identify new research pathways.

Discussion

We expected our investigation of the syllabi from two disciplines categorized by Biglan (1973a, 1973b) as hard applied (nutrition science) and soft pure (political science) to reveal curricular differences grounded in the characteristics associated with each discipline. The nutrition science undergraduate curriculum prepares professionals for the workplace and the graduate curriculum focuses on

communicating as future scholars. The political science undergraduate curriculum emphasizes learning about the methods and theories of the field, while the graduate curriculum focuses on applying those methods and theories as researchers. Our grounded theory syllabi analysis provides insight into how each department approaches accomplishing curricular goals. Information and data information literacies underpin these efforts.

For nutrition science undergraduates, collecting and interpreting data is an important part of working with patients in a future professional role, while interacting with the scholarly literature is supportive of participating in scholarly discussion and lifelong learning. By contrast, political science undergraduates are adopting a political science perspective to analyze political events and collecting and analyzing data as part of initial forays into conducting political science research. In the nutrition science graduate curriculum, information literacy supports communicating as a scholar. However, in the political science graduate curriculum, data information literacy is a large part of understanding and conducting research, while information literacy supports developing a critical stance. More research is necessary to determine if these themes are consistent with syllabi in nutrition science and political science programs at other institutions. To allow our understanding of the two curricula to emerge from the data, we observed grounded theory procedures (Birks & Mills, 2011), and waited to explore related materials until after the data analysis was complete.

Some of the observed differences in the two curricula may originate in the difference between a highly externally prescribed curriculum, such as nutrition science, and one with a greater degree of latitude in course development, such as political science. We compared our findings to advocacy documents related to information and data information literacies in each of these fields. The professional organization for dietitians and nutrition professionals includes the Accreditation Council for Education in Nutrition and Dietetics (ACEND), which accredits undergraduate nutrition programs. ACEND (2015) has published a list of competencies, which nutrition science faculty use as a benchmark to develop courses and syllabi. The courses taught in Purdue's nutrition science program adhere closely to the requirements of its professional accreditation body, as might be expected. The American Political Science Association, the major advocacy body for political science scholarship and teaching in the U.S., does not publish standards to guide political science education. However, based on the Information Literacy Competency Standards for Higher Education (Association of College and Research Libraries (ACRL), 2000), ACRL's Law and Political Science Section (LPSS) (2008) has published guidelines identifying information literacy competencies intended to inform higher education curricula.

Analyzing syllabi on coverage of data related activities revealed that learning how to work with research data is seen as an important component of a student's education. However, we also observed that student education in research data is much more focused on traditional data literacy issues of consumption, rather than on a broader program of data consumption and production as expressed in data information literacy. This current lack of inclusion of data production issues in a student's educational experience may represent an area of opportunity for librarians. A recent statement by political science journal editors released in 2014 (Data Access and Research Transparency, 2014) indicates a growing emphasis on ensuring access to data and on transparency in political science research. Moreover, a LPSS (2014) survey of political science librarians revealed that 96% of the 26 respondents identified "data literacy", broadly defined, as an important educational need that should be addressed in forthcoming revisions of the information literacy competencies. In providing a nuanced understanding of how data are used within the political science curricula, our study suggests ways of framing library services to support data information literacy needs that may resonate with the learning goals of the political science curricula. This may be true for nutrition science as well.

Limitations of the study include differing levels of detail and varied dates of revision in the syllabi we collected. Also, it should be noted that individual educational experiences aligned with specific majors, tracks or individual study, were not the focus of our investigation, which aimed to explore departmental-

level curricula. A significant part of learning for graduate students may occur through faculty mentoring, and, therefore, was not revealed through our analysis of the syllabi. The primary purpose of the study was developing a robust method for understanding departmental curricula to inform liaison librarians of opportunities to provide data information literacy and information literacy services. The liaison librarians participating in this research are now determining how to use the findings to support information and data information literacy within each department. In the following section, liaisons describe their initial reflections.

Liaison reflection 1: Nutrition Science

The primary benefit of analyzing the Nutrition Science curriculum using a grounded theory approach has been a deeper familiarity and understanding of the curricula for me. I have a more holistic view of the program and a better lens into the preferences and teaching styles of individual nutrition science faculty. I can make more intelligent choices about when to conform to faculty preferences and when it might be better for students if I introduced some mild disruption into my teaching approach. This has also afforded me a more complete visual map of the emphases and gaps in data and information literacies in the nutrition science curriculum and the possibility of creative ways to fill the gaps and support the emphasized instruction.

After presenting our preliminary findings at a nutrition science faculty meeting, I've had several substantive conversations with faculty. One was with an experienced faculty member with whom I've taught an honors course and a new graduate scientific writing course. We discussed ways of tweaking those courses and information literacy was a more explicit part of the conversation than it has been in the past. She voiced concerns that the curriculum includes very little actual writing and is interested in discussing ways to correct that. This information will be helpful as we strategize new activities and assignments for her courses. I also met with a new faculty member engaged in designing a freshman course specifically for nutrition science majors. He is very aware of information literacy and is proposing three class sessions in which I would work with students on an assignment requiring them to collect and analyze research articles. He would also like freshmen to be introduced to EndNote citation management software, which has never before been proposed by the department.

Although the focus of this approach has been to analyze what students are being currently taught, I believe it will help us to provide more student-centered instruction as we strive to address gaps we have uncovered through the analysis process.

Liaison reflection 2: Political Science

The analysis of the syllabi enables me to assist departmental faculty with their teaching activities, which vary from instructor to instructor depending on the learning outcomes for each individual course. Lower-level course syllabi in which students are required to use information are an excellent opportunity to approach departmental faculty and offer my expertise and availability to instruct students on finding, using, and analyzing peer-reviewed journal articles and other forms of scholarly communication used by political scientists. At the same time, course syllabi emphasizing the importance of promoting academic integrity present opportunities to emphasize the criticality of proper citation methods.

As political science students become more advanced in their subject knowledge and mastery, they will be introduced to the use and analysis of data sources. This provides further opportunities. Methods of working with departmental faculty and students in these courses may include describing how to use and analyze statistical data from easily identifiable components as simple as determining poverty rates for individual communities to using detailed and multifaceted data sets for identifying and analyzing health care costs and expenditures for multiple countries. As a political science librarian, supporting such activities gives me opportunities to provide experiences of tangible and enduring value to political science students and faculty in their ability to find, use, manipulate, and cite these governmental and

nongovernmental resources. These principles also apply to the use of audio-visual materials, geospatial information, and visual analytics which are becoming increasingly prominent in political science teaching and research.

These developments require that I continually research and study disciplinary scholarship to enhance my knowledge of trends and developments. Thus enabling me to demonstrate to the political science faculty my ability to understand, analyze, and discuss, the research and instructional technology they seek to impart to students.

Conclusion

Comparison of the findings from our analysis of the nutrition science and political science curricula revealed major benefits to using a grounded theory approach. In contrast to other approaches used to analyze syllabi, the inductive nature of the grounded theory approach developed for this project allowed us to understand how data information literacy and information literacy related to a number of themes within curricula. As described by the liaisons participating in this research, the holistic understanding developed through this approach provides the necessary information for designing and suggesting data and information literacies services to departmental faculty in ways supportive of curricular learning outcomes.

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