Entering Unfamiliar Territory

Building an Information Literacy Course for Graduate Students in Interdisciplinary Areas

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Guest Columnist

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There has been a long-standing interest within the academic librarian community to provide support for graduate students involved in interdisciplinary research. This column focuses on the challenges that researchers face when seeking information in an unfamiliar disciplinary area as well as what is known about the information behaviors of interdisciplinary researchers. Using a framework of information seeking strategies, elements of a course for interdisciplinary graduate students are proposed. Topics that are addressed are learning about the culture and language of an unfamiliar discipline; including the scholarly communication apparatus and organization of information; mechanisms for identifying and locating key authors, publications, research institutions, and emerging research fronts; how to determine when enough information has been gathered; and keeping up with the latest research.—*Editor*

Given the increase in the number and interest in interdisciplinary programs and research in U.S. institutions of higher education, academic librarians should be involved in determining the information literacy needs of graduate students in interdisciplinary areas.[1] Don Spanner expresses this need in his published study of a group of interdisciplinary researchers:

> Is it solely the domain of scholars? What is the "trickle down" effect on students as curriculum shifts to encompass interdisciplinarity? Such a determination would allow reference librarians to consider the importance of developing the necessary bibliographic instructional skills to support both scholars and students in their research.[2]

Recent studies of the information needs and behavior of interdisciplinary researchers, including graduate students, demonstrate that researchers have difficulties discovering authoritative information sources when venturing outside their major field of study.[3] What approaches have librarians and other information scientists found for teaching graduate students about developing vocabularies and learning about core information sources outside of their main disciplinary domains? This article attempts to answer this question by first exploring the information behaviors of interdisciplinary researchers and the difficulties they face in locating the key sources of information outside their disciplines. From this review and analysis, information literacy instruction approaches are proposed for creating a course for interdisciplinary graduate students on the following topics: learning about the culture and language of an

unfamiliar discipline; how new research is communicated and made accessible to others; identifying and locating key authors, publications, and research institutions through chaining, or footnote chasing; probing activities to increase breadth of information gathered through searching multidisciplinary databases and federated search products; networking; keeping up with the research literature; and the integration and consolidation of interdisciplinary knowledge.

CHALLENGES OF INTERDISCIPLINARY RESEARCH

Lynn Westbrook describes interdisciplinary research as "the purposeful weaving together of two or more disciplines that are usually considered to be quite unconnected in order to reach a new understanding, create a new academic end product or advance research on a particular question."[4] From an extensive literature review of issues facing interdisciplinary researchers, themes that emerged are the need to learn the language and culture of the other discipline, the information-scatter issue for highly distributed research areas, the nature and quality of bibliographic apparatuses to search for information, and keeping up with current research.

For interdisciplinary researchers, there is a need to become familiar with the cultural assumptions, language, and the organization of knowledge in the "other" discipline.[5] Being able to communicate with those outside one's own discipline requires knowledge of the vocabulary of the other discipline. In addition, terminology may have a different meaning across disciplines. This can lead to similar research being conducted in different disciplines.[6] Allen Foster reports the challenges for interdisciplinary researchers in identifying key research studies, themes, disciplinary communities, and the important authors in a field.[7]

There is also the issue of information scatter as described by Lynn Westbrook:

> "Scatter" is a measure of the number and structure of the resources in an academic discipline. Traditional academic disciplines are tightly defined with a relatively small number of professional organizations, scholarly journals, heavily used reference tools and periodical indices.[8]

Within a well-established discipline, such as geology, information resource scatter will be low and highly identifiable. Women's studies, on the other hand, is seen as being a "high scatter" interdisciplinary area where information resources are highly dispersed across a number of disciplines. Scholars in such fields have a greater learning curve,[9] and the need to gather more information and have more contacts is higher than disciplinary scholars.[10] For highly scattered interdisciplinary areas, this can be a barrier for assistant professors who also have responsibilities for teaching and tenure requirements.[11] In the realm of bibliographic databases, there are ease of use issues related to multiple interfaces, varying amounts of depth

and specificity in indexing, and inconsistency in the use of controlled vocabulary and acronyms across all subject areas.[12]

Other challenges for interdisciplinary scholars are the need for current information and in keeping up in multiple disciplinary areas. This is also true for disciplinary scholars. The difference lies in the amount of literature to review and the information scatter discussed above.[13] Carole Palmer describes the myriad tasks that interdisciplinarians face:

> Keeping up with and using information across fields requires maintaining awareness of the many different facets of a research problem, the new work in relevant subjects, as well as potential emerging areas of importance.[14]

In summary, challenges for interdisciplinary researchers include learning the culture and language used in an unfamiliar discipline, identifying key researchers and research areas, and developing a method for keeping up with new research findings across disciplinary areas.

INFORMATION-SEEKING BEHAVIORS OF INTERDISCIPLINARY RESEARCHERS

A useful framework for teaching graduate students in interdisciplinary programs is to follow the categories of information-seeking behaviors that have been variously described in the library and information science literature. David Ellis's grounded theory approach for describing information-seeking behaviors of researchers is a good place to begin the exploration of models of information seeking activities.[15] Based on interviews with social scientists, chemists, physicists, and English literature scholars, Ellis found similar information-seeking practices used by researchers in disparate disciplines even though the terminology differed. Ellis's information-seeking model has the following categories:

- Starting/initial familiarization/surveying—initial information search (literature search, etc.)
- Chaining/chasing/verifying—following references from one source to other relevant information sources
- Browsing—semidirected searching (used by social scientists)
- Differentiating—identifying and differentiating between types of publications, journals and publishers, generalist and specialist (social scientists)
- Selection and sifting/source prioritization—prioritizing importance of sources
- Monitoring—keeping-up-to-date on specific publications or areas of research
- Extracting—mining a specific journal for relevant articles
- Assembly and dissemination—bringing material together for publication.

Allen Foster bases his model of information-seeking behavior on a study of interdisciplinary researchers at the University of Sheffield, UK.[16] Three key processes of Foster's

nonlinear model are

- Opening or beginning exploration—this includes such processes as networking, keyword searching, browsing, monitoring, and chaining;
- Orientation—identification of keywords, existing research, key disciplines, and problem definition or "picture building"[17]; and
- Consolidation—this is an iterative phase of refining, sifting, verifying, "knowing enough" and finishing.

The three key processes occur in a matrix of three elements: The *internal context*, the extent of knowledge already known to the researcher and level of experience. The *external context* includes limitation on time and conditions when entering an unfamiliar discipline such as access to resources, network of contacts, and navigation issues. The *cognitive approach* has to do with how information is processed, such as the ability and willingness for flexibility, openness, holistic thinking, and "nomadic thought."[18] Nomadic thought is similarly described by a researcher in Spanner's study: "a fox knows many things. . . . so I would describe myself as a fox or a kind of rhisomatic thinker—a kind of root system that extends out."[19]

Carole Palmer, who has written extensively about information behavior of interdisciplinary researchers, describes the knowledge strategies used by interdisciplinary researchers, which can be summarized as (1) recruiting theoretical or applied experts; (2) consulting with colleagues and known authorities; and (3) learning, or the practice of "building one's own knowledge base."[20] This article will focus on this last strategy of building a knowledge base, which seems particularly appropriate for graduate students in their role as novice researchers.

A MODEL COURSE FOR GRADUATE STUDENTS IN INTERDISCIPLINARY PROGRAMS

What would a course for teaching graduate students interdisciplinary information-seeking skills look like? Taking into account the known challenges for interdisciplinary researchers and the findings from recent information seeking studies, the following is offered as thematic elements for such a course:

- *Orientation*. Becoming familiar with the language and culture of an unfamiliar discipline. Understanding the organization of information for a specific discipline and the organization of information in academic libraries and specific disciplinary databases.
- *Chaining/citation linking*. Following references found in bibliographies as well as conducting citation searches in such databases as the Web of Science and some search engines, such as Google Scholar.
- *Browsing/probing*. Exploring a semidefined area of interest and determining networking mechanisms.

- *Monitoring*. Keeping up with current research and knowledge of research fronts.
- *Consolidation and integration*. Refining and sifting through information resources and knowing when enough information has been found.

This proposed course ideally would be co-taught with a librarian and a disciplinary instructor involved in interdisciplinary research. The disciplinary instructor would provide the disciplinary framework where real-world problems could be brought into the classroom for scenario-based problem solving activities. The librarian would provide the information-literacy perspective to address the many information-seeking challenges of interdisciplinary researchers.

As noted by Foster, and well known to instruction librarians, information-seeking behaviors are iterative and nonlinear.[21] How to model this in the classroom? Foster's suggestion is to start with simple research tasks and search strategies and build up to more complicated research scenarios and tasks, information sources, and searching techniques.[22] This could be adopted in the interdisciplinary graduate student course outlined below.

Orientation

Exploring Disciplinary Cultures

One of the more formidable challenges for those working in an interdisciplinary program or research project is to become familiar with an unknown disciplinary culture and its language.

Repko describes the characteristics of a discipline as having the following elements:[23]

A. phenomena, or what the discipline is concerned with, assumptions underlying the concepts and theories of a discipline
B. concepts and commonly accepted vocabulary
C. research methodologies
D. theories, or generalized explanations of how a particular phenomena works
E. epistemology—"what can be known about the world and how it can be known."[24]

One approach to understanding the structure of a field is to compare the known disciplinary culture, methodologies, and language with an unfamiliar disciplinary field. SantaVicca recommends a model using parallel logic for teaching students how to compare the way that two different disciplines are organized.[25] This provides students with "perceptual and cognitive skills" for developing knowledge in an interdisciplinary environment.[26] The first step involves comparing the definitions and organization of the two different disciplines using the language and texts from disciplinary practitioners themselves. SantaVicca suggests using quotations from a variety of practitioners in the field to represent how those

in the discipline define themselves.[27] The quotations could be found in textbooks, autobiographies, and biographies of noted practitioners. Another approach is to determine how academic departments or professional entities organize themselves into fields of study.

Another approach would be to assign essays from a disciplinary encyclopedia that describe the history of the discipline. This would provide an understanding of the development of the discipline as well as why a discipline developed in a particular direction. Students would also learn about current areas of interest as well as those areas considered secondary or peripheral areas. Other approaches suggested by SantaVicca include reading articles that address the future of the discipline and interviewing practitioners in the field for their perspectives.[28]

An approach for identifying key disciplinary terms and their meanings would be to introduce students to the concept of controlled vocabulary and thesauri. Palmer recommends having graduate students compare the meaning of words from one discipline to another.[29] Students could be given an exercise to choose an interdisciplinary topic, identify controlled vocabulary terms for that topic from at least two different disciplinary databases, and note the differences in the terms and their usage.

Scholarly Communication Mechanisms and the Organization of Information

With a familiarity of the disciplinary culture and language, the next segment of the course would focus on how new knowledge is transmitted in the discipline. Does a discipline use rapid communication methods to report new findings or does it rely on monographs to communicate new thinking? Having knowledge of the scholarly distribution mechanisms provides students insight into the types of communication and publication modes used by the discipline.

A good place to begin is to introduce students to the appropriate guides to the literature, such as Harner's *Literary Research Guide* or Malinowsky's *Reference Sources in Science, Engineering, Medicine, and Agriculture.* The guides not only provide information on disciplinary indexes and abstracts but are useful in identifying core journals, professional societies, and conferences.

SantaVicca's comparative model would work well in familiarizing students with the bibliographic indexing and abstracting apparatus of differing disciplines.[30] This type of exercise allows students to develop mental models and experiences with contrasting disciplinary databases. Students could be asked to compare the scope, sophistication of indexing, searching capabilities, as well as any inadequacies of the databases.

For a more rhetorical approach, Searing recommends having students explore a research problem or question from a number of perspectives.[31] In an interdisciplinary area where the bibliographic mechanisms may not be well established, this can provide an opportunity "to explore 'scholarly and institutional inclusion and exclusion,' to interrogate the division between 'academic' and 'popular' sources and to present reference works as 'cultural artifacts.'"[32]

Chaining/Citation Linking

Chaining, or footnote chasing, and cited reference searching are important information-seeking processes that graduate students should master. As Palmer notes,

> This is a standard practice for researchers and scholars in most fields, but because of the dispersion problem in cross-disciplinary work, this technique may be the best or only way of identifying pertinent material in peripheral bodies of literature.[33]

Students should be introduced to cited reference searching through the Web of Science (WOS) from Thomson Reuters, if available. Cited reference searching allows for identifying newer articles that cite a known article instead of chaining or following references back in time. In addition, students should explore the WOS "Analyze Results" function that extracts data from search results to identify the top ten authors, source publications, and institutions.

Students should also become familiar with other bibliographic databases and search engines, such as PubMed, EbscoHost, Scopus, and Google Scholar that present links to cited by or related works in the search results.[34] Students should also be made aware of the CrossRef functionality available in many e-journals.[35]

Browsing/Probing

Probing activities are especially important in fields where there is a high degree of information scatter across multiple disciplines. For example, in an interdisciplinary area such as neuroscience, applicable article and monographic sources could come from such disparate disciplines as psychology, physiology, speech and language processing, cognitive science, and numerous medical-related fields. In such a high-scatter interdisciplinary area, probing activities are critical. Westbrook notes that in these cases, "Breadth is more critical than depth; connections are more meaningful than detail."[36] Learning goals for this segment of the course should include students developing a knowledge and facility with multidisciplinary databases, such as WorldCat and national catalogs and bibliographies; federated searching products; e-journal collections, such as JSTOR; Project Muse; and other large multidisciplinary search engines such as Google Scholar.

If the library has a federated search product such as MetaLib, Central Search, or WorldCat Local, then students should become familiar with the search functionalities and limitations. During the course, students will have learned how databases are organized and how they can be searched effectively, so they should be able to apply their learning to navigate the idiosyncrasies of the federated search system as most are currently constituted.

INFORMATION LITERACY AND INSTRUCTION

Graduate students should have knowledge of the capabilities and limitations of Google Scholar and Google Books as sources for probing the information universe for a specific interdisciplinary topic and author. Academic and scholarly search engines, such as Intute (www.intute.ac.uk), should also be presented.

Probing not only helps researchers gain familiarity with topics of interest in an unknown discipline, it also provides ideas for new research areas and can lead to a change in research direction as more information is gathered.[37]

Networking

For researchers and scholars, networking happens at conferences, seminars, and local presentations. What works for grad students looking for guidance in an unknown area? Where can they go to find colleagues and mentors outside their own discipline? For this course segment, students would be asked to interview at least one or two faculty involved in their disciplinary and interdisciplinary area to learn about the networks and networking strategies that these established researchers use and then report back to the class. The disciplinary instructor also can provide examples of useful networking activities from his or her experiences. The librarian instructor can direct students to social networking sites for professionals, such as LinkedIn, Ning, H-Net (Humanities and Social Sciences), among others, as well as blogs and e-mail lists.[38]

Monitoring

One of the final sections of the course should be devoted to techniques for keeping up to date with current developments in the chosen disciplinary fields. Once students have identified key researchers, journals, and publishers for their field of study, then it is important that students are aware of and know how to use RSS feeds and e-mail alerts as a means of monitoring new issues of journals and current news from professional society websites. Many of the large e-journal collections, such as Science Direct, Project Muse, and BioOne, offer e-mail alerts and RSS feeds. Major database providers, such as EbscoHost, Cambridge Scientific, and Chemical Abstracts, have RSS feeds and e-mail alert functions. In addition, most academic integrated library systems offer e-mail alerts for new acquisitions. RSS feeds can also be set up from blogs and websites of professional societies and individual researchers.

Research Fronts

In rapidly developing interdisciplinary research areas, it is important to have an awareness of emerging research areas, known as "research fronts." Graduate students in the sciences should be familiar with Thomson Reuters's "research front maps" and should have a basic understanding of the underlying method.[39]

Other topics that should be addressed in an interdisciplinary graduate course, such as information management, will not be presented here, since they are not related to information seeking and gathering activities, which are the focus of this article.

Consolidation and Integration

According to Repko, interdisciplinary research is an integrative process and requires a degree of decision making at many points in the research process to reach "an interdisciplinary understanding."[40] Foster sees this occurring through "a combination of thinking, writing, and discussion."[41] The disciplinary instructor can provide guidance in how to consolidate or refine a research focus and how to determine whether enough information has been gathered. Prabha et al. found that the decisions concerning whether or not enough information has been gathered are based on the requirements of the research project and time and resource constraints.[42]

CONCLUSION

Interdisciplinary researchers have difficulties identifying key information sources outside their main field of study. The instructional model offered here provides an information-literacy framework for educating graduate students for interdisciplinary work. The model uses the concepts of information-seeking behaviors of researchers to structure an approach for exploring an unfamiliar disciplinary culture and vocabulary, concepts in scholarly communication and the organization of information within a discipline, and how to examine the bibliographic database apparatus and gain experience in effectively searching bibliographic databases and search engines. Other topics concerning information-seeking practices that graduate students should learn are how to locate other researchers with similar interests, how to keep up-to-date with the latest published research and emerging research fronts, how to consolidate and integrate the collected information and data, and when to stop the information-seeking process.

Knowing how to identify an information need and understanding the underpinnings of where to locate that information provides a solid foundation for being successful in the information probing, gathering, sifting and consolidation process. As Oberg states in his article on understanding the difficulties facing interdisciplinary researchers,

> Scholarly training that encourages and strengthens the ability to reflect upon research and learning processes on a meta-procedural level will therefore facilitate both collaboration and the production of high-quality work in interdisciplinary environments.[43]

Academic librarians have a responsibility to ensure that graduate students have the information-literacy skills to thrive in an interdisciplinary environment.

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