''Information Survival Skills'': a medical school elective

Sarah Knox Morley, MLS, AHIP; Ingrid Claire Hendrix, MILS, AHIP

See end of article for authors' affiliations.

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Objective: The authors developed an elective course to assist students in (1) understanding the changing nature of scholarly communication and online publishing, (2) identifying resources and strategies for searching current best evidence, and (3) demonstrating effective communication of information.

Setting: The course took place in a medical school in the Southwest.

Participants: Second- and third-year medical students participated in the course.

Intervention: A pass-fail, undergraduate-level elective was first offered October to December 2006. This 7.5 hour course, developed and co-taught by 2 health sciences library faculty, consisted of hands-on exercises, small group discussion, and didactic lecture.

Conclusion: Presenting a medical school elective is one possible outlet for intensive bibliographic instruction. Illustrating the flow of information from creation to management and presentation affords students an opportunity to understand information in context. This elective has been consistently ranked very high in student evaluations and led to new and expanded teaching opportunities.

INTRODUCTION

Physicians must be able to locate current literature in their field, evaluate the information they find, and use and communicate that information to various audiences. The ability to locate, evaluate, and use high-quality, appropriate literature is a skill recognized by the Association of College and Research Libraries, the American Association of Medical Colleges, and the Accreditation Council for Graduate Medical Education [1–3], as well as other major health professional associations [4]. While the term ''information literacy'' may not be widely recognized in the field of medicine, medical schools have integrated information literacy into the curriculum in the guise of evidence-based medicine (EBM), medical informatics, and research skills [5–10]. At the University of New Mexico (UNM), Health Sciences Library and Informatics Center (HSLIC) faculty are involved with medical student education at various points throughout the four-year program. Library faculty take part in new student orientation, act as tutors for problem-based learning (PBL) groups and in the EBM block, provide single session instruction as requested by faculty members, offer drop-in labs for search skill practice, are available for one-on-one consults, and participate as judges at the annual student research day.

This case study describes a five-week, pass-fail, undergraduate-level elective developed in 2005 by two library faculty members. This UNM School of Medicine (SOM) course, ''Information Survival Skills,'' was taught for the first time in the fall semester of 2006 and has been taught yearly since. Fifty-one students participated in this course over the five-year period.

Supplemental Table 2 is available with the online version of this journal.

CURRICULUM BACKGROUND AND DEVELOPMENT

The three phases of the SOM curriculum provide a foundational framework for the development of this elective. Phase I is organized around organ systems, each incorporating three perspectives: biologic, behavioral, and population. Phase I lasts approximately twenty-one months, encompassing medical school years 1 (phase I-1) and 2 (phase I-2). Phase II (year 3) includes problem-based tutorial learning in both inpatient and ambulatory care settings. During phase III (year 4), medical students spend time on various inpatient services (i.e., pediatrics, family medicine, neurology, obstetrics/gynecology, and psychiatry).

All medical students are required to take an evidence-based practice (EBP) course woven into the first three years of medical school. Content includes large group sessions and computer labs. Due to frequent changes to the curriculum, EBP content is delivered at various points throughout these years. UNM also has a research requirement beginning in the first year culminating in a written scholarly work and poster presentation in the fourth year. The objectives of this requirement include participating in the scholarly process by developing skills in question formulation, locating and evaluating primary research literature, thinking critically, and writing and presenting in a public forum.

During the first 3 years of the medical school curriculum, electives in the Perspectives in Medicine (PIM) series are offered during the fall and spring semesters. Each elective consists of 5 sessions lasting 1.5 hours, for a total 7.5 contact hours. First-year students have required electives each fall, which focus on issues of diversity, and are therefore ineligible to take other offerings. Second- and third-year students may select from an array of topics such as futile medical interventions, mind-body medicine, medical

Spanish, or medical ethics. Faculty members may develop courses and submit them to the UNM Office of Undergraduate Medical Education for approval; therefore, offerings may vary. The Office of Undergraduate Medical Education assigns students to electives based on preference and availability.

In 2005, the HSLIC faculty embarked on an initiative to educate the UNM Health Sciences Center faculty about scholarly communication issues [11]. During this same period, one of the authors (Morley) was invited to present a library resources lecture to phase I-2 students prior to the start of their ward rotations. Informal conversations with faculty, residents, and third-year medical students led the authors to realize that issues surrounding scholarly communication and optimal and efficient use of resources were an area of need. As facilitators of PBL groups in the Transitions Block just prior to the start of the clerkship years (year 3), the authors saw that students were relying on resources of questionable quality (i.e., ''Drs.,'' Google, and Wikipedia) to research learning issues. Despite library instruction early in their medical school career, many second- and third-year students lacked information about resources and effective searching.

Offering this information elective was thought to be an opportunity to address scholarly communication, the open access movement, library budgetary issues, and knowledge management, in addition to providing search skills training. The authors felt strongly that this should be an alternative to the typical bibliographic instruction sessions often provided to students. As some researchers have noted single-session training is less effective than more comprehensive instruction [11, 12]. The goal was to present the information cycle from inception through dissemination phases. Rather than didactic instruction, the course was designed around active learning principles with a strong experiential component.

Course faculty, the clinical services and the nursing services librarians, have worked as a team to develop and teach the course. Both faculty members bring a strong skill set in searching and instruction to developing and teaching this elective. Both instructors have primary faculty appointments in the SOM; the nursing services librarian has a secondary appointment in the UNM College of Nursing. Due to her experience attending post-call rounds with internal medicine teams, the clinical services librarian is also able to advise students on the importance of certain resources and expectations of residents and attending physicians in gathering and presenting information. The nursing services librarian has extensive knowledge of personal file management software programs and open access publishing. Development of the course took approximately six months.

Course objectives

The course objectives were to teach students to: (1) understand the changing nature of scholarly communication and online publishing, (2) identify and use resources and strategies for searching current best evidence, and (3) communicate and organize findings using presentation and reference management software.

Table 1
Student numbers for Perspectives in Medicine (PIM) elective

Year	Term	Total	Phase I–2	Phase II
2006	Fall	12	6	6
2007	Spring	7	7	0
2008	Fall	12	5	7
2009	Fall	12	6	6
2010	Fall	8	8	0

Course format and educational strategies

This elective took place over 5 class sessions, each lasting 1.5 hours. Depending on availability, sessions were held either in a library computer classroom or in a library conference room equipped with wireless network and a ''classroom on wheels'' (COW). The COW has 16 laptops with internal wireless cards and a projector. In addition, the library has 2 computer classrooms available for hands-on instruction. One classroom has 12 student stations, and the other has 22 student stations. Both are equipped with a projector, screen, and audience response system (''clicker'').

Each session incorporates hands-on exercises, group discussion, paired activities, and brief didactic lectures. Following adult learning theory and practice [13], lectures are kept to a minimum. Occasionally, clicker technology is used to gauge student knowledge about topics as well as to guide discussion. Based on clinical scenarios that students could expect to encounter during clerkship rotations, hands-on exercises are utilized to develop search strategies and techniques. Oral student presentations take place during the final session.

Course sessions

A total of fifty-one students participated over a five-year period (Table 1). Students, polled in the first elective, indicated an equal third made this elective their first choice and a third their second or third choice. The remainder did not select an elective and therefore were assigned to the course. Subsequent polling has shown a steady increase in the number of students choosing this elective as their first choice.

Table 2 (online only) provides an outline of the five sessions of the course. Session one begins with an anonymous pre-assessment questionnaire designed to gauge student knowledge, perceptions, and use of information resources. The questionnaire (''Information Management Assessment'') was adapted with permission from the Mulford Library, University of Toledo. Survey results are not in any way tied to an individual student, nor are students required to complete the questionnaire. All collected data are aggregated for use by the instructors to determine

students' baseline knowledge of library resources and services and to inform educational practice and enhance future teaching.

Following roundtable introductions, an overview of the publishing process including journal subscription costs and the open access movement is provided. The authors feel this is an important component to include so that students are more informed consumers and producers of information by understanding how the current publishing process works and how the open access movement has evolved. Additional content related to scholarly communication includes: common elements of a scientific article, selection of a journal for publication, resources for author instructions, the peer review process, copyright issues, and plagiarism. During this session, guidelines are provided for the final student presentation.

Session two covers the process for identifying an information need and determining the appropriate resources to fulfill that need. The focus of this session is the optimal method for formulating a research or clinical question using the patient/problem, intervention, comparison, outcome (PICO) format. Students are given a complex scenario adapted from case studies found in Access Medicine and from cases presented during internal medicine post-call rounds. Using these case-based scenarios, students construct a PICO question, which is then critiqued in the larger group. After question formulation, students are divided into pairs and assigned different point-of-care or bibliographic resources with which to answer their question. Some of the resources evaluated are AccessMedicine, DynaMed, PsycINFO, PubMed, and UpToDate. Students later share their experiences such as their search strategies and success (or failure) in answering their question using the various resources. Other students then provide critiques and alternative search strategies. Further discussion is held elucidating the differences between point-of-care resources, bibliographic databases, and popular search engines.

To expose students to resources other than the familiar PubMed and Google, they review additional resources such as Cochrane Database of Systematic Reviews, PubMed Clinical Queries, and the National Guideline Clearinghouse in session three. This session only briefly covers EBM concepts because this material is addressed elsewhere. The format for presenting this content is similar to session two, when students are presented with a clinical scenario, are divided into pairs to answer PICO questions, and then present their findings through demonstration and discussion.

Session four, ''What You and Your Patients Are Reading,'' features critical appraisal techniques for research studies and evaluation of websites and consumer health resources. Students watch part of a health literacy video [14], followed by a discussion about their own experiences with health literacy. Students explore MedlinePlus and discuss key elements to consider when evaluating websites. During this session, students are introduced to the use of personal file management software. In keeping with the authors' original concept of educating students about the information life cycle, session four stresses the importance of managing information. The RefWorks citation software program was chosen because the library has a license and therefore provides free access to the students. Students are given practice time in class to set up an account, download citations from PubMed, and create a bibliography.

For the final class session, students are expected to choose content from the course and synthesize the information in a presentation to their fellow students. This open-ended assignment is meant to give students an opportunity to practice presenting for rounds or educational conferences. Students are given only five to seven minutes, thus requiring them to be succinct. Presentation topics range from retaining copyright, ways to add journal styles in RefWorks, and point-of-care resources for researching specific PBL issues. Using a rubric, faculty instructors provide individuals written formative feedback assessing presentation clarity, organization, topic relevance, and content knowledge.

Throughout the elective, students are furnished with topic-related articles and resource lists reinforcing content and providing them with handy reference tools [15–22].

OBSERVATIONS

During the elective, the instructors observed that the students' skills and experiences with library resources are fairly limited, particularly for second-year students. PubMed is familiar to all the students, although few indicate a strong comfort level using it. Most were very conversant with Wikipedia, Google, and UpToDate as their major sources of information. It was interesting (albeit somewhat discouraging) to discover that, with all of the resources the library provides, many of the students had used so few of them and were, in fact, unfamiliar with many key resources. It appears, despite previous instruction, students often focus on immediate needs, which might not necessitate familiarity with the full range of offered resources. This is particularly true for students in the preclinical years, and the mix of second- and third-year students and of their priorities confirms their different needs. For instance, students on ward rotations are frequently responsible for patient education, and these students reported session four was helpful to them:

> [S]o helpful to what I am doing on wards and really improved my skills as a medical student. One of the recommendations I received in a previous wards evaluation was to improve my skills in literature integration into my management of patients and this course really helped me do that.

Second-year students had no frame of reference and therefore did not see the value of this patient education session and topic. On the other hand, there are benefits to mixing student populations. Third-year students frequently mentor students who have

Table 3
Mean scores from post-course evaluation

Statement	Mean (n=42)
The course met its stated objectives	4.64
The course was well organized	4.78
The course was well suited as a PIM elective	4.74
The content was appropriate for students at my level of professional development	4.69
The material was presented in such a way that it enabled the course objectives to be achieved	4.62
I plan to use what I learned in this course in the future	4.65
I would recommend this course to students in the future	4.55

Students were asked to evaluate each statement using a scale of 1 (strongly disagree) to 5 (strongly agree).

not yet had clinical experience. Regardless of year, students supported each other in skill and technology development.

EVALUATION

Anonymous online evaluations were collected at the conclusion of each course by the UNM Office of Undergraduate Medical Education. Overall, the elective received high marks (above 4.5 on a scale of 1 to 5), especially in content areas and organization. Data from the course evaluations and from the pretest and posttest were similar across the 5 years of the study, so means were calculated using all combined data. Table 3 contains data from post-course evaluations from years 2006 through 2010.

In addition to the formal SOM evaluations, the course instructors invited students to complete a post-course assessment. This anonymous paper-based form was the same as the pre-course assessment given during the first session. Table 4 contains data from four years because posttest data from 2009 is missing. The greatest increase in skill level was seen in the use of RefWorks, followed by website evaluation. Showing the least amount of change were patient information and creating posters.

Using accepted practices in qualitative methodology, data collected from the open-ended questions were systematically reviewed, discussed, and coded using content analysis [23]. Major themes include database exposure and search skills, RefWorks, and hands-on practice.

Final evaluations illustrate that students recognize the benefit of the elective to both clinical and research experiences; however, this is self-reported data. As a pass/fail course, there is no summative assessment of student skills and knowledge retention.

DISCUSSION

Some students said PubMed and Medical Subject Headings (MeSH) skills were the least useful because they had been covered at the start of medical school; however, equally as many comments suggested the need for more PubMed searching skills: ''PubMed searches just because we've had some MeSH teaching in the past. I wouldn't cut it out though because I still learned some neat tricks.'' In terms of most useful content, other students noted, ''refWorks *[sic]* for sure! Also learned so many databases that I will be able to apply in many cases. Cochrane, Dynamed *[sic]*, etc.'' Another stated, ''The databases presented in class will serve as an invaluable tool throughout my career.'' While a third said, ''I will use all the search parameters and strategies that were taught to us. This course was the most practical and useful PIM I've ever taken!'' Additional comments related to placement of this content in the curriculum (e.g., earlier and better integrated).

The PIM electives, already part of the formal curriculum, offer an established point in which to incorporate essential information skills. Having an existing placeholder obviates the need to add additional content to an already packed curriculum. In addition, the research requirement that starts in year 1 and culminates in year 4 with a poster presentation provides an opportunity for the library to reach students with practical, meaningful content. The SOM research requirement dictates that students complete a literature review of their research topics and either present or publish their findings. These skill sets are presented and developed during the course of the elective, demonstrating short- and long-term value to students. One student commented that he would use the ideas he learned ''In writing research proposals and drafts.'' Few students reported exposure to citation software for managing their information, and many commented on how beneficial it was. RefWorks received 17 mentions (n=42). Despite

Table 4
Mean scores from information skills pretest and posttest and difference between the tests

Task	Pre (n=34)	Post (n=30)	Difference (post–pre)
Defining the topic	3.06	3.87	0.81
Identifying keywords or subject headings	3.09	3.90	0.81
Finding evidence-based information	3.03	3.87	0.84
Using a database to identify articles	3.12	3.93	0.81
Sharing information with patients	3.06	3.59	0.53
Using bibliographic management software	1.71	3.23	1.52
Creating a poster presentation	2.30	3.00	0.70
Assessing the effectiveness of information skills (Did I successfully find information I was seeking?)	2.84	3.70	0.86
Assessing the reliability/validity of information on the web	2.59	3.77	1.18

Students were asked to identify their skill level for each task using a scale of 1 (no skills) to 5 (expert skills).

student enthusiasm for the research skills component, feedback reflected a lack of interest in the publishing process. Most students were not yet in their careers where they understood that publishing and presenting were relevant, therefore they considered the publishing content relatively unimportant.

Hands-on exercises and peer learning provide students an opportunity to apply and share their search skills, explore unfamiliar resources, and practice presentation skills: ''I also learned little things during the class from the instructors and other students that I wouldn't have thought of otherwise.'' Students in this elective are encouraged to work in pairs and small teams, solve problems, and contribute to one another's learning. Throughout the course, faculty instructors guide learners, allow mistakes, and model good information behaviors.

LESSONS LEARNED AND NEXT STEPS

A recurring request from students was that the course allow even more hands-on searching time: ''Give us more time to 'play around' with what we learn about, like an optional 30 minutes *after* the class to try it out and ask questions.'' Suggestions for improving the course informed the development of a second elective focusing on search skills and RefWorks. Offered for the first time in the fall of 2011, the ''Art and Science of Searching'' elective also received high marks (mean 4.91, SD 0.30) on a 1 to 5 Likert scale.

Furthermore, presentations regarding the initial elective at the 2009 Western Group on Educational Affairs annual conference and the 2011 SOM Education Day garnered encouragement from a variety of faculty and administrators to offer similar content to faculty. Working with the SOM Teacher and Education Development Department, the authors designed a four-hour faculty development workshop, ''Navigating the Information Maze: Resources for Teaching and Assessing Informatics Skills,'' to be taught summer 2012. This educational offering, a much abbreviated version of the initial PIM elective, is intended to assist the faculty in becoming more proficient in using, as well as guiding their students to better use, information resources.

CONCLUSION

Effectively searching the literature and understanding information in its context is not an innate ability. Without instruction, students tend to fall back on familiar and less reliable standbys such as UpToDate and Google, respectively, and not the wide array of scholarly resources available to them. The elective described here took an evolutionary approach to the concept of information: how it is created, uncovered or discovered, managed, and presented. The focus was on developing students' skills in understanding the information environment and scholarly communication to make them more informed participants and consumers of information. Additionally, the authors focused on expanding their repertoire by introducing them to unfamiliar, high-quality resources and efficient ways to search the literature and manage and present their findings.

Unfortunately, electives, in general, only impact a very small portion of the medical student body each year. It is therefore imperative to identify any and all opportunities to offer information content. All of these skills are vital to students in their clinical and research endeavors and as future health care professionals practicing EBM. The content presented in this elective can be adapted for a wide range of health care students and professionals. By identifying opportunities in the curricula they serve, health sciences librarians demonstrate their important educational role.

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AUTHORS' AFFILIATIONS

Sarah Knox Morley, MLS, AHIP, smorley@salud .unm.edu, Clinical Services Librarian; **Ingrid Claire Hendrix, MILS, AHIP,** ihendrix@salud.unm.edu, Nursing Services Librarian; Health Sciences Library and Informatics Center, University of New Mexico, MSC09 5100, 1 University of New Mexico, Albuquerque, NM 87131-0001

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