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## Engineering Integration: Building a Quick and Effective Faculty Seminar

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# TOWARD ENGINEERING INTEGRATION

## Building a quick and effective faculty seminar

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### ABSTRACT

In the spring of 2010, the Science & Engineering Library of the University of Minnesota-Twin Cities partnered with the Information Literacy Librarian and offered a faculty seminar to the College of Science and Engineering. The seminar's goals included 1.) refreshing and expanding faculty's knowledge of information and 21st century literacies and 2.) creating a community of faculty committed to developing student skills in finding, evaluating and synthesizing information in their academic coursework and into their professional careers.

Overall, the seminar increased faculty understanding of services and expertise of the libraries, and 21st century literacies. It also developed and strengthened ties between individual faculty members and their subject librarians, leading to a mix of outcomes from a faculty member partnering on a grant the Libraries applied for to course integrated instruction sessions to faculty participating in an e-textbook pilot. This seminar provides a strong model for re-framing information literacy in the context of teaching and learning in science and engineering, giving librarians an opportunity to strengthen relationships and increase liaison effectiveness.

## INTRODUCTION

The difficulty of integrating information literacy into science and engineering curricula has been explored in the library literature for over a decade (Hardesty, 1995; Leckie & Fullerton, 1999; Bracke & Critz, 2001; etc.). Bracke and Critz stated the issue succinctly, “the expectations and philosophies of their [undergraduate science and engineering students] faculty add an additional layer of complexity to teaching information literacy” (2001, p.100). Our institution is no different: required technical content fills the curriculum, leaving little room for flexibility. The curriculum focuses largely on problem sets and lab assignments that often require little library research. Many faculty members believe that library research and information literacy skills get covered in other courses as part of the general education requirements. McGuinness found in interviewing faculty that, “one of the more striking themes to emerge was the pervasiveness of the belief that the extent to which students develop as information literate individuals depends almost entirely on personal interest, individual motivation and innate ability, rather than on the quality and format of instructional opportunities” (2006, p. 577).

The University of Minnesota-Twin Cities is a large, research institution. The College of Science and Engineering has 12 departments, more than 4,800 undergraduates and a graduate student population of more than 2,600 students. Faculty members have robust research and publication commitments along with a full roster of teaching duties. In the spring of 2010, the Science & Engineering Library partnered with the Information Literacy Librarian to offer a 1.5 day long library seminar to the College of Science and Engineering faculty and instructors. The

seminar aimed to refresh and expand their knowledge of information and 21st century literacies, as well as the tools and services that the Libraries offered to support and enhance this skill set.

Librarians had a hit-or-miss record of integrating information literacy content in individual classes. Successful integration was often tied to individual relationships with specific instructors and lacked strategic integration in the curriculum. In interactions with faculty, subject liaisons often heard comments such as “I didn’t realize the library offered that...” or “I know it’s not part of your job...” indicating a disconnect between the classic conception of the library and emerging roles and services that our libraries offered. This seminar addressed that disconnect while simultaneously increasing faculty’s skills in these areas. The desired outcome of the seminar was to create a cohort of faculty advocates who could set a foundation for deeper integration into the curriculum and additionally create experts that could pass the information along to their colleagues and students.

## BACKGROUND

The Libraries first offered a faculty seminar in 2005. It was partly modeled on the Mellon Library/Faculty Fellowship for Undergraduate Research at the University of California, Berkeley. The Berkeley program was extensive: a two-week long institute with follow-up support from an “I-team” for implementation with experts in educational technology, library, and pedagogy and an opportunity for getting more funding for additional course transformation (Mellon Library/Faculty Fellowship for Undergraduate Research, n.d.).

The 2005 program was smaller than the Berkeley program with 13 instructors from

across campus. The Berkeley program worked off the principle that "...librarians can (and should) effectively partner with faculty in the design of courses, curricula, and assignments" (Maughan, 2008, p. 13). Using that statement as a guiding principle the planners adapted materials from the Berkeley program for the seminar. This seminar was a success and a learning experience. The seminar planners made many suggestions: shorten the time, include more hands-on activities, focus on specific types of research assignments and bring together individuals from the same discipline to collaborate on assignment design. The Libraries set money aside to offer this program again but organizational changes delayed this offering until 2010.

## PLANNING AND OUTCOMES

Based on feedback from the original planners, we wanted to limit our focus to one college. In the 2005 seminar, although many colleges were represented, no one from the science and engineering faculty participated; thus, we decided to limit enrollment to the College of Science and Engineering. This decision allowed us to focus the content to a core audience. Instead of trying to make a general assignment like the five page essay, common in the humanities, relevant to the science and engineering faculty, we were able to target specific research needs and assignment types common in these disciplines like lab reports, senior design projects, and independent undergraduate research projects.

We wanted to create a community of faculty and instructors committed to developing student skills in finding, evaluating and synthesizing information in their academic coursework and into their professional careers. We wanted participants to be able

to share their experiences and ideas. As Maughan notes, two of the most valuable aspects of the Berkeley program were, "questions and insights from colleagues" and "learning from peers" (2008, pg. 17). We hoped that this cohort model would demonstrate to the attendees that they were not alone in struggling to impart these skills to students.

Adult learning theory includes the belief that learning needs to be driven by the needs and interests of the learners (Maughan, 2008, p. 9). Our intention was that the sessions would teach instructors new skills. We wanted, as Iannuzzi said in her seminal article, to "...use information literacy to help faculty succeed in their own objectives" (1998, p. 100). By illustrating how these skills could benefit them personally, we hoped it would inspire them to model and teach these skills to undergraduate students in their courses, graduate students they mentor, and potentially, colleagues with whom they collaborate. We hoped that this "train the trainer" method would provide a form of "trickle down" information literacy.

We developed the following four ideal seminar outcomes. We used these outcomes as a foundation when building the content of the day. As a result of the seminar participants would...

- Reflect on teaching practices and assignments to improve students' ability to conduct scholarly information research, critically evaluate information, turn data into meaning and effectively convey new knowledge.
- Explore issues around scientific scholarship, including publishing, copyright and open access, and be

able to prepare students to negotiate the publishing world themselves.

- Consider strategies for managing data and be able to advise Undergraduate Research Opportunities Program students and research group members on this topic.
- Learn how to keep up with the literature and increase productivity with information gathering and organization tools.

Most faculty learned research differently than their students. Many of them completed their undergraduate and graduate work before the Internet, during a time of information scarcity, hampered by a lack of print availability. Now students must learn to do research in a landscape where abundance, rapid change and information overload rule. Of course, faculty members today also face these same challenges and thus we focused on the following areas:

- Advanced search with databases like Web of Science, Google Scholar and Google Books
- Current awareness tools like RSS feeds and table-of-contents alerts
- Citation managers including RefWorks, Zotero and EndNote/EndNote Web
- Publishing, open access, and copyright
- Data management

This seminar was organized quickly. Planning meetings started at the end of March and the seminar dates were set for the middle of May. The Science & Engineering Librarians had developed a rich selection of workshops designed for faculty and graduate students in previous years, and

we decided that this content would provide the foundation of the seminar. We organized Day 1 to be focused on information literacy skill building and Day 2 to focus on deeper curriculum integration.

Each librarian took material that he or she had used in previous workshops, re-framed it, developing examples of how the content could be incorporated into an assignment, classroom or lab activity. The Information Literacy Librarian, in consultation with staff, developed a template to help guide the librarians in their preparatory work including identifying learning outcomes, outlining activities for achieving those outcomes, and the method of assessment.

We used information literacy standards including the *Information Literacy Standards for Science and Engineering/Technology* produced by the Science and Technology Section of the Association of College and Research Libraries (ACRL, n.d.) and the *Information Competencies for Chemistry Undergraduates* produced by the Special Libraries Association Chemistry Division as foundational texts (Craig & Maddox, 2007). Knowledge of accreditation standards, such as those from the Accreditation Board of Engineering and Technology (ABET, n.d.) helped us frame individual sessions and the seminar as a whole. Engineering and many of the sciences are closely aligned with the specifications of national accrediting bodies and the curricula of specific majors are rigidly prescriptive. However, the ABET standards do not explicitly include information literacy, which is problematic when trying to emphasize its importance. Currently librarians shoehorn information literacy skills into the ABET standard regarding “lifelong learning” with the belief that information seeking skills, “contribute to lifelong learning since students become

independent information seekers who can adapt to any situation and are able to transfer their learning to any future demand for research" (Roberts & Bhatt, 2007, p. 250).

Other disciplines such as chemistry have been more open to incorporating research skills within the curriculum. Being able to speak confidently of the accrediting standards was vital in a seminar like ours, so that we could be seen as meaningful and knowledgeable partners in student learning.

Although the Berkeley program was much larger in scope, we modified their program materials including the seminar evaluation. We also took advantage of information on what faculty liked about the program. Maughan found that top-rated sessions were practical, involved observation and were customized with concrete examples (2008, p. 16). Faculty liked learning from peers, gaining insights from colleagues, and building a community of interest with library partners and colleagues. Faculty wanted less theoretical abstractions, statistics, and assessment. Maughan also

found, "faculty learners mostly disliked the mention of standards, taxonomies, or attempts to measure student learning against formally stated learning outcomes" (2008, p. 17). We provided a summary and link to Maughan's article for presenters to read in preparation.

## REGISTRATION AND PARTICIPANTS

Librarians marketed the seminar through a combination of college-wide emails, blog posts, and personal email invitations. There was broad representation from across the College of Science and Engineering, and participants taught a wide range of courses from first year lectures to graduate student seminars (see Table 1).

We offered a \$250 honorarium to attendees that participated in both days of activities using funds set aside from the original faculty seminar in 2005. We hoped the honorarium would make the workshop more attractive to our very busy faculty members. We felt the honorarium would also provide us with additional leverage to follow-up

TABLE 1 — DEPARTMENT REPRESENTATION OF SEMINAR PARTICIPANTS

Department	Number of participants	Total full time and part time faculty <sup>1</sup>	Percentage attended
Biomedical Engineering	2	13	15%
Chemistry	2	33	6%
Civil Engineering	3	33	9%
Computer Science and Engineering	2	34	5.8%
Electrical and Computer Engineering	1	38	2.6%
History of Science and Technology	1	1	100%
Mathematics	2	75	2.6%
<b>Total</b>	13	227	5%

1. Employee and Student Head Counts and Student Credit Hours for Fall 2010 by Department: [http://www.oir.umn.edu/static/hrdata/Employees\\_and\\_Students\\_by\\_Department\\_Fall\\_2010.pdf](http://www.oir.umn.edu/static/hrdata/Employees_and_Students_by_Department_Fall_2010.pdf)

with faculty after the seminar concluded. As part of the registration process, participants were asked which topics they would like to see covered. The relatively even distribution of choices demonstrated that faculty and instructors were interested in many of the topics (See Figure 1). We used this data to determine how long to spend on different subjects when creating the schedule.

We sent out two pre-seminar readings:

Mackey, T., & Jacobson, T. (2005). Information Literacy: A Collaborative Endeavor. *College Teaching*, 53(4), 140-144.

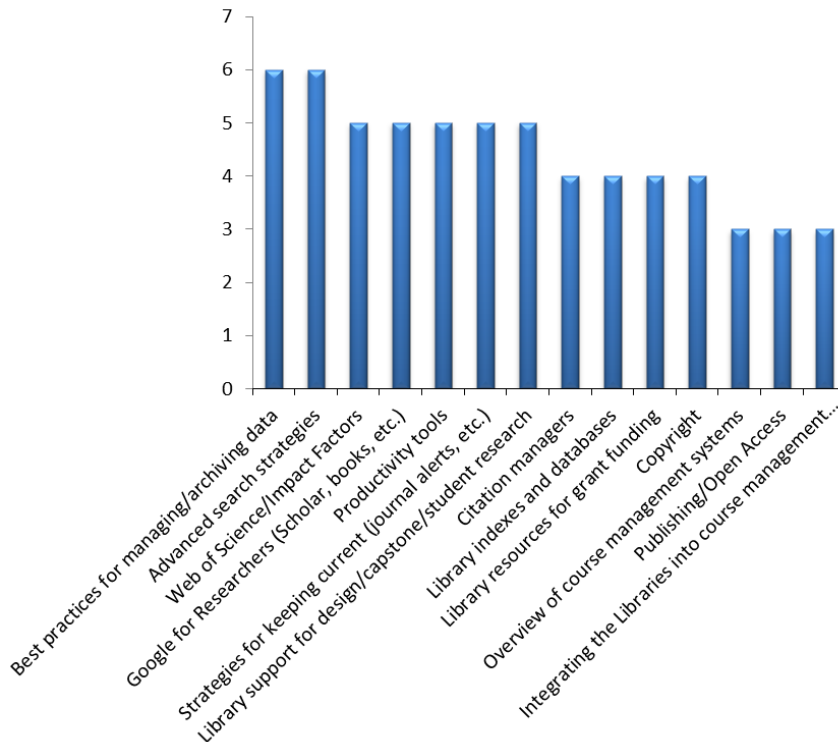
Rodrigues, R. (2001). Industry Expectations of the "New Engineer." *Science & Technology Libraries*, 19(3), 179-188.

The Mackey article had been used successfully at other events with faculty. It was non-discipline specific, very accessible and talks briefly about the importance of information literacy along with examples from the University of Albany on partnerships between librarians and faculty. Our goal was that this article would suggest the types of interactions we were hoping to see during and beyond the seminar. We included the Rodrigues article to begin to make the case that students need to learn research and information skills, that their education years was the time to learn these skills (not "on the job"), and that students with these skills will be more successful in the workplace.

### DAY ONE ACTIVITIES

We kicked the seminar off with a welcome

FIGURE 1 — REGISTRATION SURVEY RESULTS FROM FACULTY ON TOPICS TO BE COVERED DURING THE SEMINAR



from the Science & Engineering Library's Director and a keynote address from the College of Science and Engineering's Associate Dean for Undergraduate Programs, a presentation entitled, "Educating Tomorrow's Scientists & Engineers: Challenges and Opportunities." The Associate Dean spoke about the college's work in changing the undergraduate experience to increase student retention in the college. He also discussed the challenges students face such as the frustration of receiving lower grades in the first year of college compared to high school and an inability to pursue interests outside of the rigid course requirements. The College identified a lack of connection to the societal impact for the work in the first two+ years of many majors, leaving some students unsure of the goal and purpose of the heavy workloads. His talk provided a larger context for the skills we planned to cover through its discussion of the educational mission of the college. The inclusion of a college administrator provided explicit support for the seminar among participants.

The first library skills session, "Advanced Searching," focused on interdisciplinary science and engineering resources such as Web of Science, Google Scholar and Google Books (see Appendix A). We also included a short session on finding impact factors. Next was the session "Keeping Up With the Literature," in which librarians described an array of productivity tools and techniques, such as setting up Real Simple Syndication (RSS) feeds for favorite library databases, Google Alerts, and RSS Readers. We paired that content with an introduction to citation managers. In this session, we went through the most popular citation managers on our campus, EndNote (and EndNote Web), RefWorks, and Zotero, and had the attendees critically engage with the

pros and cons of each resource by walking through a series of interactive questions (What does this tool cost? How can I collaborate with this tool?). We also provided examples of ways these tools could be used to enhance or support a classroom assignment.

After these two sessions that utilized a lecture-style format, we facilitated a discussion on the topic, "What skills do College of Science and Engineering students need?" We pulled quotations from the literature around themes such as the information explosion, 21<sup>st</sup> century skills, ethical challenges and expectations of the scientific and engineering industries to facilitate the discussion (National Academy of Engineering, 2004; Hollander, 2009; Rapporteur & National Research Council, 2010; Orzel 2010). The participants broke into small groups; interacting and engaging with colleagues outside of their departments. At least one librarian also participated in each group. The discussion flowed between small group discussions and seminar-wide sharing.

The rest of the day contained shorter, thirty-minute sessions starting with a discussion of faculty members' rights as authors and steps they could take to retain rights upon publication of their research. That talk was followed by a session on copyright facilitated by our copyright librarian. It covered the fundamentals of copyright, such as fair use, and incorporated interactivity through the use of clickers. The final session was devoted to data management, walking participants through the process of good data management practice.

## DAY 2 ACTIVITIES

Day 2 focused on information literacy and curriculum integration (see Appendix B).



We asked faculty members to apply what they had learned in Day 1 to their teaching. Faculty sat in departmental groups at specific tables. We wanted to ensure that instructors would interact with participants from their departments. Subject librarians sat with their faculty in the role of participant. This arrangement was challenging as certain liaisons had multiple departments present, but we were able to move other librarians without a specific department assignment in to be sure each table had one librarian present.

We started with a survey, created using Google Documents listing a selection of the *Information Literacy Standards for Science and Technology*. We selected standards and outcomes and asked faculty to rate the importance in relation to their own courses (least, medium, most important). This idea was modified from the O’K Fellows Program, a “program to initiate collaboration between faculty and librarians to improve student’s ability [sic] to access, evaluate, and effectively use information” from the C. G. O’Kelly Library at Winston-Salem State University (C.G. O’Kelly Library, n.d.). This activity was a good way to introduce faculty to the standards and allowed us to quickly gauge their usefulness to the instructors. We then viewed the results as a group and identified those that had the highest importance, including:

- Selects the most appropriate method or information retrieval system (literature search, lab experiment, simulation, etc.)
- Understands that all resources cannot be found with just a Google search
- Critically evaluates information and its sources (i.e. uses criteria

such as reliability, validity, authority, timeliness, bias, etc.)

- Demonstrates an understanding of what constitutes plagiarism and does not represent work attributable to others and his/her own. This includes the work of research teams.

Next, we moved to “Writing Effective Course Objectives” presented by a consultant from the Center for Teaching and Learning on campus with a Pharmacology PhD and experience teaching in the sciences. This session allowed faculty to see how a peer, a fellow science PhD, developed student learning outcomes and provided support in student assignments.

That session was directly followed by an activity called the “Assignment Dissection.” We asked instructors, in small groups, to select a common assignment type (poster, laboratory assignment, or literature review/annotated bibliography). Instructors then had to select two information literacy outcomes from a given list, write two learning outcomes, and then brainstorm an assessment strategy and two activities based on the learning outcomes.

Next, we showcased many ways the Libraries could be integrated into courses. We wanted to give a number of concrete examples instructors could use in their own courses. The showcase included ideas such as: Library Course Pages (<http://www.lib.umn.edu/course/about.php>), in-class lectures by a librarian, optional out-of-class lectures by librarians, customized workshops, online tutorials, using the Archives and Special Collections, librarian consultation on a syllabus/assignment, the Assignment Calculator tool (<http://tools.lib.umn.edu/ac/>) and more. We gave

instructors a “reaction log,” an active learning worksheet that tracked initial impressions while we presented various topics in this fast-paced format.

Then instructors used the examples they had just seen in an activity called “Assignment Storyboarding.” This idea was also based on an activity from the O’K Fellows Program (C.G. O’Kelly Library, n.d.). We asked instructors to develop or modify an existing assignment from a courses they currently taught (they had been asked to bring such an example in the registration materials) using the model provided earlier in the day during the “learning goal/assessment idea” activity with assistance from their subject librarians. We then shared and discussed results. In the final activity of the seminar instructors planned follow-up activities with their librarian based on material and conversations during the seminar. Attendees documented these ideas on a form and a copy of the completed form was given to them for their records, and also kept by the subject librarian to facilitate follow-up.

## ASSESSMENT

As part of planning, librarians developed an assessment strategy for each session. This strategy included minute papers, debriefing, rating individual sessions using a Likert scale (see Table 2) and a final evaluation for the entire event. The final evaluation questions were modified from a selection of questions used in the Berkeley Program. We asked faculty to rate the value of each session along with a series of open ended questions about the seminar.

## LESSONS LEARNED

We discovered that among the participants there was a wide spectrum of skill levels and comfort with the libraries and technology, helping both novices and experts during the sessions proved challenging. In our planning we assumed participants had familiarity with these topics. Next time we may reduce the number of topics, allowing us to go at a slower pace with a more hands-on approach.

**TABLE 2 — RESULTS OF FINAL EVALUATION FOR RATINGS OF INDIVIDUAL SESSIONS (1-NOT AT ALL VALUABLE TO 5-EXTREMELY VALUABLE)**

Session Title	Average Rating
Copyright	4.62
“Support teaching and learning” showcase	4.55
Small group discussion	4.1
Assignments and review	4.08
Advanced Searching	4
Publishing and open access	4
What skills do CSE students need?	3.85
Keeping up with the literature	3.62
Assignment storyboard and work time	3.4
Data management	3.27
Assignment dissection-small groups and discussion	3.25

We also learned that providing more of an initial overview of the topics and concrete examples of how they can be applied in research, teaching and learning would be useful to participants.

Based on the final evaluation, the highest rated sessions included the session on copyright that used clickers, the showcase of Libraries' tools/services that provided authentic examples of how they could be used in teaching, and one-on-one collaboration time with librarians. Faculty appreciated concrete examples for both research and teaching. The session on learning outcomes, team-taught with an instructor from the Center for Teaching and Learning, received a mixed response. Some instructors felt the specific learning outcomes used as examples would limit students' effort. The discussion during this session was rich, but the lack of buy-in (on the effectiveness of explicit learning outcomes) negatively affected the remaining activities which utilized that concept. Next time, we will be less specific about the format of the learning outcomes in order to progress with less resistance.

Another lesson taken away from the experience was to spend more time prior to the seminar planning ways to assess the program's success. We would be more intentional to connect our assessment directly to our desired outcomes and focus less on general satisfaction of the different offerings.

### SUBJECT LIBRARIANS' FEEDBACK

In follow-up debriefing sessions, staff

agreed that using established personal connections to encourage attendance worked well. We also suggest setting up pre-seminar meetings with participants to discuss expectations, determine topics of particular interest, and establish a connection. The information gathered in these pre-seminar meetings could then be used in the program planning. We found using technology and other "unique" teaching methods (e.g., clickers) both enhanced our own teaching and served as a model to the instructors. We also found that practical examples and case

studies of what has worked in the past (e.g., Day 2 Showcase) worked well.

We had many ideas for future improvements including making the connection between the Day 1 activities and the Day 2 application into their teaching more explicit. We learned that discussing pedagogy needs to be handled carefully—a danger exists of turning people off if the discussion is too prescriptive. Adding a "what are your best tricks for teaching" session may provide a good opening to discuss instruction. Other suggestions included: inviting advisors or other staff that support students (e.g., career, academic support, etc.) to attend, bringing in a faculty member as speaker to share a success story, and planning for "afterwork" in liaisons' schedules.

### ALMOST TWO YEARS LATER

Looking back at the faculty seminar, the librarians involved identified a range of positive outcomes from the seminar. These outcomes ranged from the desired and foreseen to the more unexpected and

FACULTY QUOTE:  
 "I'LL BE RETHINKING WAYS TO  
 BETTER INTEGRATE YOUR  
 RESOURCES INTO MY  
 TEACHING."

surprising. For example, all librarians reported richer interactions when meeting faculty who had attended the seminar on campus. These faculty members had a better idea of the range of services offered by the Libraries. In turn, the seminar helped librarians identify which faculty members were open to working with the library and develop stronger faculty relationships.

Some examples of successful follow-up activities included one librarian being invited by a faculty member to speak to new graduate students during a departmental seminar, and then recruiting that same faculty member to partner with the Libraries on a grant application dealing with graduate student data literacy. This grant was awarded. One librarian reported consulting with a faculty member on emerging technologies, some of which were introduced in the seminar, to keep up with and manage the constant flow of new information. This relationship led to the faculty member consulting with the subject librarian when she was updating an assignment for her undergraduate engineering class and the subject librarian facilitating a connection with our Media Librarian to assist in the creation of an enhanced multimedia assignment. That same faculty member has since partnered with the Libraries in an e-textbook initiative, piloting the bulk purchase of electronic textbooks by the university as an alternative to students individually purchasing high priced textbooks (Young, 2012).

Not all relationships saw such dramatic results. Out of the 13 participants, slightly less than half of the faculty followed up on specific aspects of the seminar program. Those librarians, who did not see a direct uptake from their faculty, did feel that the extended face-to-face contact during the

seminar was beneficial in their long-term relationship development. Regardless, all of the librarians found value in the opportunity to showcase the breadth of the Libraries' offerings to faculty and found the investment of time during the seminar worthwhile.

## CONCLUSION

Overall we were pleased with the seminar. We accomplished our goals to increase faculty understanding of the Libraries, information literacy, and 21st century literacies. We developed and strengthened ties between individual faculty members and librarians and started a conversation among discipline colleagues. This seminar provides a strong model for re-framing existing workshops in the context of teaching and learning and encouraging one-on-one and small group work between faculty and librarians. With the reuse of content and the short planning time it has great potential for future replication. This model could easily be adapted to meet the needs of other disciplines outside of science and engineering. The creation of long term relationships between instructors and librarians has been a particularly fruitful outcome. Our faculty seminar model created a unique opportunity for subject librarians, faculty and instructors to work together toward the goal of improving students' information literacy skills in science and engineering.

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## APPENDIX A — DAY ONE SCHEDULE OF ACTIVITIES

May 19, 2010 |

9:00 am – 9:45 am	Welcome and Introductions Keynote
9:45 am – 10:45 am	Advanced Searching Web of Science, Google Scholar, Google Books
10:45 am – 11:00 am	Break
11:00 am – 12:00 pm	Keeping Up with the Literature Productivity Tools Citation Managers
12: 00 pm– 1:00 pm	Lunch
1:00 pm– 1:45 pm	What skills do IT students need?
1:45 pm– 2:15 pm	Publishing and Open Access
2:15 pm– 2:45 pm	Copyright
2:45 pm– 3:00 pm	Break
3:00 pm– 3:30 pm	Data Management
3:30 pm– 4:00 pm	Review and Expectations for Tomorrow

## APPENDIX B — DAY TWO SCHEDULE OF ACTIVITIES

May 20, 2010 |

9:00 am – 10:00 am	Survey Assignment Dissection Introduce Assignment Storyboard
10:00 am – 10:30 am	How can the Libraries help with teaching and learning?
10:30 am– 11:00 am	Work Time Assignment Storyboard
11:00 am – 11:30 am	Review Assignments Discussion
11: 30 am– 12:00 pm	Develop Next Steps