Engineering + Information Literacy = One Grand Design

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Abstract

Undergraduate engineering students in small institutions, like their colleagues in larger universities, need to be information literate, yet this is a skill that is not necessarily built into their curriculum. This paper will discuss a program that has been developed at Trinity University to address first year engineering students in their initial design course. It will cover the transition from largely lecture/demonstration-based instruction to a presentation that includes active learning components. An emphasis on the importance of written communication skills for engineers is a part of this program that has been enthusiastically endorsed by the engineering faculty.

Introduction

Recent literature reiterates the importance of information literacy for engineering students and the role of librarians in promoting that process. The challenge is to develop a program that delivers the instruction when the students need it, and in a manner that catches their attention, allows them to practice new skills, and appeals to a variety of learning styles. The use of lectures as the primary instructional vehicle has become increasingly devalued, as reflected in student evaluations of bibliographic instruction as well as studies by learning theorists. Successful combinations of lecture/demonstrations with a variety of active learning techniques have been reported.

Background

Trinity University is a small (c2500 student FTE), private, liberal arts institution that is almost entirely made up of undergraduates. Unlike many schools with a similar description, it also includes a Department of Engineering Science, whose mission is to “provide students with a broad-based undergraduate engineering education by offering a design-oriented, multidisciplinary engineering science curriculum in the context of the University’s traditions of the liberal arts and sciences.” The key phrase is “design-oriented”, which translates into participation in engineering design projects throughout the eight-semester design course sequence. Thus it is highly advantageous to reach students in their first semester to give them the fundamentals of locating and evaluating information from the design literature.
As the library liaison to the engineering program, I began making contacts with their faculty after arriving at Trinity in September, 2000. Initially my instruction was limited to upper level classes, where it was apparent that the students had little library experience and no awareness of the wealth of databases we could provide them. By the fall of 2003, after a number of months of discussion and encouragement, the instructor for the first design class was convinced that his students needed help. One of their assignments was to identify a problem on campus (typically related to life in the dormitories) and develop a solution as part of a mini-design project. The required steps in the process included researching the literature for relevant information. Frequently the instructor only saw results from Google searches, whereas journal articles and patent descriptions might have been more helpful. He was also interested in having the students learn more about the communication process in engineering, particularly in terms of different types of writing. He was willing to include me in class activities and give up an entire period (75 minutes) for both sections of the course so that I could provide an introduction to library research and literature. Total enrollment for the course averaged 50 students.

The Library Component, 2003

To become better integrated with the students, I attended the first day of class, received an overview of the course and the professor’s expectations, introduced myself briefly, and participated in a “name game” to help students get to know each other. On a small campus it is easier to become acquainted with and recognized by the students, and anything one can do to promote this relationship is worth the effort in terms of benefiting their college careers.

Later in the semester, after the students had chosen partners and selected a problem for their mini-design project, I returned to their classroom. In the fall of 2003 the library had just been renovated to include an information commons and a computer classroom that provides seating and individual computers for up to 27 students. Due to its popularity, it can’t always be scheduled when needed, which was true for the design class that semester. Thus I was using a classroom with one master computer and no opportunity for students to get hands-on experience. As is my custom with library instruction, I assumed the role of a student, described a problem that was prominent in my life (excess dog fur all over the house), and did the research to help develop my solution (a vacuum cleaner to use on pets). My presentation was a combination of lecture and demonstration, covering Compendex, Applied Science and Technology Abstracts, the U.S. Patent Office’s database, and a few commercial websites highlighting product information, design sites, and standards, with a dash of humor stirred in. While there was some exchange of questions and answers during this part of the class, any learning was largely passive and student evaluations indicated a desire to follow along with individual computers.

To support their own research after the class, I prepared a web page and a handout that described not only those resources that were presented in class but also a number of other potentially useful resources not mentioned. I also developed a research log for the students to fill out and turn in with their final report. It covered the sources that they used (at least two library databases, the Patent Office database, the Thomas Register website, and Google or another search engine).
what terms they searched, an indication of best items (if any) from each source, and an open-ended question about what source was most useful and why. If students can develop the habit of keeping this kind of log as they do library research, they will find that their searching becomes more efficient and their chances of discovering helpful resources are increased. For this class the logs were returned to me and provided useful feedback about students’ searching skills and their attitudes about the research process.

The second part of the class focused on written communication within the engineering field. During the demonstration of databases the students were presented with the concept of peer-reviewed literature and the differences between scholarly, trade, and popular publications. As an exercise they were divided into four groups of up to six students, and the members of the groups were given an article related, per the class “theme”, to vacuum cleaners. Each group had a different article, selected from a scholarly or trade journal, a popular magazine, or a website. However, all information related to the author and the source was deleted, so the only information the students had was the article title and the text itself. They were given 10 minutes to read the article and analyze as a group the type of publication from which it came, the background or training of the author, the probable audience, and the intent of the article (to educate, inform, persuade, sell, etc.). They were also asked to grade it in terms of how well it achieved its purpose and, for fun, to guess what sex the author was. Each group selected a spokesperson to report their conclusions to the rest of the class.

In general the students did quite well on this exercise. The groups in both class sessions correctly identified the scholarly journal article (universally noted as “boring” and for too specific an audience to engage students). They had a little trouble differentiating between trade and popular articles and failed to recognize the website source, which was definitely more difficult (a write-up for a lab related to vacuum cleaners for an engineering class at Clemson University). They were able to designate the authors’ backgrounds in general terms and had a good idea of the audience and purpose of the articles. Grading was all over the map, depending upon the punitive nature of each group. In almost all cases the authors were considered to be male, even though one article was written by a woman. Perhaps engineering students still think of this as a man’s field, despite the female members of their classes.

Several weeks after my research instruction, the students presented their final designs to the class. I sat in on these also and was pleased to note that several people specifically mentioned library resources they had found that helped them with their designs. Involvement with this class from the beginning of the semester until near the end, including being listed on Blackboard as an assistant, represented a level of instructional participation that seems highly desirable for academic librarians.

Evaluations

In 2003 feedback was provided by faculty and student evaluation forms and by the research logs the students turned in with their final project. The student form asked for scaled responses (from “strongly agree” to “strongly disagree”) to a series of statements related to the information
presented and the performance of the instructor. The majority of these were positive, either “strongly agree” or “agree.” Only one statement elicited neutral and negative responses, as one might expect from “A vacuum cleaner is man’s best friend.”

Students were also asked to note what had helped them the most and the least during the instruction session. Most helpful were the databases, the library website and how to negotiate it, and the library catalog. Least helpful for a third of the students was the article exercise; they failed to see why it could be useful for them. On the other hand, it was a feature that the course instructor felt was very important, and in terms of information literacy it seemed to provide an awareness that students might not gain on their own. There were also complaints about the “dead end” searches, which I used to illustrate that research is not always easy and that some databases are less appropriate for specific topics or approaches. I had to agree with one comment, that “Compendex doesn’t look worth the effort.” For beginning students looking for design literature, it is not that useful a resource, and it was dropped for my 2004 presentation.

The instructor’s primary suggestion for future classes was to conduct them in a computer classroom so that each student could follow along with the web-based search for references. This was echoed by student comments on their research logs. Most poignantly, “Trying to recreate the success Ms. MacAlpine had with the library’s database, we realized she made it look much easier than it is. If the lesson could have been interactive with us actually following instructions on the computer while she gave them, we think our individual search would have been much more productive.”

The Library Component, 2004

Fast forward one year. Two sections of first year Trinity students were enrolled in their first engineering design class. The course was being team taught, with the primary classroom instruction assigned to a second year faculty member. The mini-design project was still part of the curriculum. Good communication between the library liaison and all the engineering faculty ensured that library research instruction was valued and would continue, but with modifications to make it a better experience for the students.

What remained the same were the first day introductions, the allocation of a full class period for library instruction, the handouts and library website for the course, and the vacuum cleaner theme. What changed in the first design class in the fall of 2004? As everyone desired, it was held in the library’s computer classroom, so each student had access to his/her own computer. The 75 minutes were divided into smaller “bytes” that started with a much shorter introduction to library databases, not including Compendex. This was followed by an active learning component in which students, working in their mini-design teams and with their research logs, did some searching for their own topics. I was free to walk around the room and make suggestions or answer questions. This activity lasted 10-15 minutes and was followed by a general discussion of techniques, successful searches, and the inadequacies of some databases for specific topics. My second demonstration covered the Patent Office database and the necessity of installing a
TIFF file viewer to access the images. There were several vacuum cleaners for pets among the patents, so this was a particularly successful site to introduce. The class ended with the article exercise, with a longer explanation about its purpose being only indirectly applicable to the mini-design projects.

More Evaluations

There wasn’t time for in-class evaluations in 2004, so the primary feedback came from the research logs. These were required for the final report, were graded by the librarian, and accounted for a small percentage of the final grade on the mini-design project. Almost all of them received the maximum number of points; many of them had good analyses of why a particular database (or Google) was most effective for their topic. While a few teams reported spending only an hour on their library research, most of them were involved significantly longer. Perhaps most telling was the student who commented on his log that the sources “were very helpful, but time consuming” and that “researching was the hardest part of the whole project!”

Conclusions

Developing relationships with faculty that allow librarians to become involved with providing their students with bibliographic research instruction is only the beginning of an information literacy program. Through readings, discussions with colleagues, and especially the input from student evaluations, one learns that less can be more—as in less time spent on lectures and demonstrations, combined with more active learning components, can lead to greater proficiency and more information-fluent students. The library instruction program for first year engineering students at Trinity University will continue to evolve, based on input from the faculty, students, and trends noted in the professional library literature. Our next revision will try to take into account any changes in performance by students who have had this instruction as compared with their upper level classmates who missed the sweeping changes brought about by the vacuum cleaner presentations.

Bibliography

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