AC 2010-623: SUMMER ENGINEERING EXPERIENCE FOR GIRLS (SEE): AN EVOLVING HANDS-ON ROLE FOR THE ENGINEERING LIBRARIAN

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Summer Engineering Experience for Girls (SEE): An Evolving Hands-On Role for the Engineering Librarian

Abstract

The summer of 2009 marked the third year that the EQT Corporation sponsored a two-week Summer Engineering Experience for Girls (SEE) at Carnegie Mellon University. The program’s goal is to provide junior high girls the opportunity to learn of the appeal of engineering as a career choice by demonstrating how engineering contributions make the world “a better place.” The girls complete an application and attach a copy of their latest report card, a teacher recommendation form, and a one page essay explaining their interest in SEE. Twenty+ participants per year attend the July program free of charge. Librarians are invited to participate each year to provide research assistance. Our approach has changed over time from a one-shot lecture style to co-teaching two hour long sessions that promote step-by-step strategies for conducting research. These sessions include instruction on how to locate energy related websites and how to evaluate them, how to develop presenting and writing skills, and how to properly document sources used in their final presentation. SEE faculty continue to develop their instruction modules based on demonstrated successes from each year. This paper will discuss the impact that the librarian can make during one-on-one interactions with the SEE students and the lessons learned over a three year program cycle.

Introduction

As self-described on their website, http://www.ices.cmu.edu/see/, the Institute for Complex Engineered Systems (ICES) is part of the Carnegie Institute of Technology (CIT), the engineering college at Carnegie Mellon University. Since 2007, ICES has hosted an educational outreach two-week July program for middle school girls. Various Carnegie Mellon faculty members, including a Carnegie Mellon University undergraduate summer intern, along with Engineering and Science Librarians from the University Libraries have worked to create a worthwhile learning experience for the SEE—Summer Engineering Experience for Girls—participants from local Pittsburgh schools. The 2009 schedule is included in this paper to provide a view of the type of sessions incorporated in the program (see Appendix).

Literature Review

A survey of the literature concerning engineering curriculum for girls reveals some broad treatments of the subject. Following WWII-era handbooks offering engineering career guidance to girls by listing vocational options for various science careers, two types of literature that inform this paper appear increasingly prominent from the late 1970s.1,2,3 The first may be characterized as literature concerned with student perceptions and the representation of professional scientists and engineers. The second is more concerned with pedagogical strategies and programs designed for pre-college girls. Both treatments
generally approach the subject as a way to identify and combat gender disparities in
science and engineering professions through instructional changes.

Perhaps most emblematic of the representational literature is the Draw-a-Scientist Test
offered by Chambers in 1983 and modeled by several others. More recent Draw-
an-Engineer tests continue to be used to explore both misconceptions of the engineering
professions and gender gaps of interest in science, technology, engineering, or math
(STEM) professions. Literature based on these tests indicates that pre-college students
tend to portray scientists and engineers as men. In the case of engineers, students also
misperceive the breadth of engineering professions, favoring the image of the civil
ingineer actively building structures. Similar representational studies regard the
effect of the gender of the instructional agent in generating response from girls. An
interesting and recent study from Plant, Baylor, Doerr, and Rosenberg-Kima uses a
computer-based learning environment and argues that female agents help generate
interest and encourage girls to participate in engineering-related projects.

Literature advocating pedagogical strategies that encourage girls to participate in STEM
disciplines tends to cover three broad groups: general advocacy and classroom
environment strategies, reports on large-scale curriculum initiatives with an emphasis on
students under-represented in STEM professions, and reports of science and engineering
programs designed specifically for girls. Classroom and environmental strategies include
discussing female role models in science and technology throughout history, encouraging
of risk-taking through non-graded projects, requiring engagement with technology for all
students, engaging student interests and hobbies to relate the subject matter, and
encouraging group work among students.

A cursory review of ASEE First Bell reports,
http://www.asee.org/publications/firstbell/index.cfm; eGFI posts, http://www.egfi-
k12.org/; and localized sources such as ICES SEE’s “Links to other outreach programs
around Pittsburgh,” http://www.cs.cmu.edu/~sfinger/see/ indicates an on-going stream of
educational initiatives aimed at providing outreach to pre-college students
underrepresented in science and engineering fields. Accordingly, publications regarding
such academic programs for girls in science and engineering comprise another important
sector of pertinent literature. Large-scale initiatives like the TexPREP, Connecticut Pre-
Engineering Program, and High Schools That Work include fully-integrated coursework
for middle and high school students—a majority of whom represent women and minority
groups. Reports on programs like this typically describe program design and details,
funding issues, demographic data of the participants, and both qualitative and quantitative
data to bolster analysis of program success. Programs of this type generally include
students of both genders but are designed for specific groups based on such factors as
socioeconomic status or academic achievement. The reports on these programs often
refer to the need to expose pre-college students to science and engineering professions in
order to encourage post-secondary participation. The Engineering is
Elementary—EIE project provides a wealth of research findings on their website,
http://www.mos.org/EiE/research_assessment.php#formalfindings, including perceptions
that teachers and students have about engineering.
There is currently insufficient data to determine how many scientific programs or camps for girls are available though figures from the American Camp Association, a camp accrediting organization that works with roughly a quarter of camps nationwide, estimate a 140% increase from 1998-2007. This dramatic increase, however, does not equate to a large share of the total number of camps accredited by the organization.\textsuperscript{18} Plotkowski, Sheline, Dill, and Noble argue that camps such as these have a positive effect in promoting participation in STEM disciplines and professional organizations like ASEE have produced the most pertinent literature on these types of camps and programs within the past decade.\textsuperscript{19} This area of literature generally considers its goal to promote STEM professions to girls through the development of curricula and social programs. Like the reports of large-scale initiatives, these reports address program goals, content, and outcomes. The reports may also offer suggestions for other institutions for successful implementation or present statistical analysis for assessment purposes.\textsuperscript{20, 21, 22, 23} In many ways, this paper represents an extension of these publications that detail academic programs for girls in science and engineering. At present, more literature can be found that addresses the subject of how groups, including librarians, can have a role with influencing girls towards considering traditionally male dominated fields.\textsuperscript{24} One difference the authors hope to demonstrate in this paper is the positive involvement of librarians and other information professionals in contributing to these crucial outreach programs.

Year One – 2007

SEE was implemented at Carnegie Mellon University in 2007. The Faculty Advisor sought the assistance of the Principal Librarian, liaison to the Civil and Environmental Engineering Department. The two-week program started on Monday, July 16, 2007 with seventeen students. On Friday of the first week, the middle school girls were provided a lesson on conducting research by two of the University’s Science Librarians and their assistants. Teaching students at this level was an unexpected but welcoming new frontier for the University Librarians.

Session Day

In the first year, two hours were set aside for the research portion of the program. The librarians were invited to help the students find credible resources that would provide information on their topics. Initially, some time was set aside for a tour of the Engineering and Science Library. However, shortly before the start of the summer program, the librarians were questioning giving a tour at all. They really could not predict whether the SEE students would come back on their own time, given their tight pre-set schedule for the two weeks that they were on campus. The decision was made to simply meet the SEE students at a University computer cluster conveniently located in the same building as the Engineering and Science Library. The SEE students sat five to six per row, and each had a computer. They were given login-in privileges.

Explaining the research process
Librarian participants were introduced and the Engineering Librarian surveyed the SEE students to be sure that they all had an approved research topic. Many were still unclear as to a subject of interest. Packets were passed out that included web pages from engineering organizations; the *U.S. Army Corps of Engineers Education Center*’s “Kids Links” web page, [http://education.usace.army.mil/govlinks.cfm](http://education.usace.army.mil/govlinks.cfm); the *U.S. Department of Energy’s Office of Energy Efficiency and Renewable Energy—EERE*, [http://www.eere.energy.gov/](http://www.eere.energy.gov/); and an adaptation of the classic “Seven Steps of the Research Process” handout.

Step 1  Identify and Develop Your Topic  
Step 2  Find Background Information  
Step 3  Use Catalogs to Find Books and Media  
Step 4  Find Internet Resources  
Step 5  Evaluate What You Find  
Step 6  Use Indexes to Find Periodical Articles  
Step 7  Cite What You Find Using a Standard Format

An introduction into the online catalog was made by the librarian instructor’s search of the University Libraries’ *Cameo*, projecting the results onto a screen. Selected book records were examined. Once the concept of subject headings was broached, the librarians quickly realized that, at this point in their research experiences, the SEE students were not going to benefit from such a level of analysis. In fact, even a display of an item record in an online catalog was soon acknowledged to be a foreign concept to them. The class was asked if they knew what the record represented, “Do you know that what you see is a description for a book that we have in our library?” This led to a brief discussion of online and/or card catalogs available to them at their school libraries. A few indicated that they still used card catalogs to find books. Despite the best intentions of the librarians in planning the lecture, realistically, the SEE students were not going to begin researching their topics by using the most appropriate subject headings.

Introducing the database

The University Libraries subscribe to the online encyclopedia, *AccessScience*. This choice was more appropriate for locating background information. In hindsight, an online encyclopedia may have been a better starting point than an online catalog. This resource features easy to locate subject categories at the top of the home page as well as colorful images and clearly written text. SEE students were introduced to study guides in the Environmental Science category. They were encouraged to look at Unit 5 *Energy Resources and Consumption* and try their hand at the “Renewable Energy Resources” quiz, [http://www.accessscience.com/](http://www.accessscience.com/). The purpose of this exercise was to break up the lecture. The exercise also introduced new ways to consider the topic of renewable energy. The girls had the opportunity to discuss their findings with their neighboring classmates as they answered the questions.
The class was then asked to consider how they would describe a database. An analogy was made to the FBI fingerprint database by explaining that fingerprints are the data, the database organizes them, and then more data (more fingerprints) can be added to it. To clarify further, additional real world analogies were made by the librarian instructor. An example was given, for instance, that if an engineer discovers a new way to get energy or to use energy, he or she would write about this research in a magazine that is called a journal. The Engineering Librarian held up an issue of the *Journal of Energy Resources and Technology* before passing it around so that the class could see what it looked like.

An initial thought was that the SEE students would be able to find some articles on their topics without knowing how to choose a database. They could use a federated searching tool to select an engineering category designated to simultaneously search across many databases. The keywords entered would generate a search in nine databases at the same time, including the University’s online catalog. The ability to locate full-text articles was also demonstrated, showing results from three separate searches: energy consumption AND costs; homes AND energy usage; and electrical energy AND reduce. The last search resulted in what was considered a great heading or phrase to use for future searching: renewable energy sources.

Due to the fact that they would only have access to Carnegie Mellon proprietary databases for two weeks, the SEE students were informed that their public and school libraries also have access to databases. Particularly, the Carnegie Library of Pittsburgh was promoted since its online databases are available to anyone with a Carnegie Library card. Therefore, the SEE students who lived in Allegheny County or were a Pennsylvania resident with an Access PA library card could obtain a free Carnegie Library card. The Carnegie Library provides a research help page via its website, [http://www.clpgh.org/research/](http://www.clpgh.org/research/), that includes science and technology related research databases, such as *Applied Science & Technology Full Text*.

Teaching smart searching

Web site evaluation was next on the agenda. The SEE students were prompted to ask themselves these questions every time they viewed a new web site: “What’s the purpose of this web site? Are they trying to sell you something? Influence you? Where are they getting their information? Can you tell if a high school student created the web site or if a commercial company created it?”

The phrase “renewable energy sources” recommended earlier in the presentation was searched on Google. The search results were projected for all the SEE students to see. Librarians presumed that the SEE students had some web searching experience but did not try to survey them on the variety or extent of their experiences. Therefore, the reasoning for the search steps and the choice of keywords was explained as the search was executed.

The Engineering Librarian pointed out that her first page of results included sites from the U.S. Department of Energy’s Energy Information Administration—EIA. An EIA link
followed the Wikipedia link. The SEE students were challenged to consider how they, not the search engine, would prioritize the results. How could they prudently choose from the many available links? In fact, the Carnegie Mellon librarians were very pleased with the age appropriateness of the EIA Energy Kids link, http://tonto.eia.doe.gov/kids/. A copy of the section “Energy Facts” was provided in their handout to use for future reference. The Engineering Librarian also briefly reviewed the significance of domain names using the EIA as a .gov site. Since the Department of Energy (DOE) is a large government agency, a web search of “renewable energy sources” would expect to include sites from doe.gov. Other domains covered included commercial or .com; education or .edu; and organization or .org.

Another search was performed in Google. This time, the phrase, “plug-in hybrid cars” was used. By showing the many .com sites in the results, the SEE students were asked to consider why this was the case. They were challenged by these questions, “Many of these .com sites are news items proclaiming the wonderful benefits of the plug-in hybrid car, right? But, do we know where these sites are getting their information about the cars? Can we believe what we read?” Even if the students do not choose an engineering career, the expectation was that this lesson would train them to carefully consider a source’s reliability.

The discussion turned back to .gov sites, specifically reviewing two additional handouts. The U.S. Department of Energy’s Office of Energy Efficiency and Renewable Energy site—EERE offered a student specific resource page for students interested in learning about energy. Plus, the Minerals Management Service maintains a “Kids Pages” site, http://www.mms.gov/mmsKids/, with a role-playing activity called: “How Many Does it Take? Watts it to you?” The SEE students were encouraged to share the site with their teachers when they returned to school in the fall. The Engineering Librarian wanted to provide critical thinking moments by offering a variety of resource choices for the SEE students to analyze. Finally, the students were advised to try out different search engines other than Google, such as Vivisimo. A quick search in Vivisimo using the terms “hydrogen fuel cells” displayed results by relevancy but also in a column on the other side of the webpage in groups, known as clusters. Vivisimo’s useful categories served as an effective means of choosing from the many results.

Assisting with independent research

After the lecture, the SEE students were told that they could now log-in to the computers for the half an hour hands-on session. Two librarians and two information assistants were nearby to help them search for information on their topics. Nothing formal was explained for Step 7—properly citing their sources—except to tell them that they should keep track of where they were finding the information and make note of this at the end of their presentation.

As a wrap-up and farewell, the library team mentioned places to go for information about women in engineering. Printed copies to the front webpages of organizations that promote women in engineering and engineering careers were distributed. One
information assistant was charged with introducing them to a wide variety of different career paths that they could take in engineering. The information assistant felt that this part of the session “was good because it brought a practical application to the day. With much of the focus on their research project and how to do the research…it was nice to have a discussion just talking about what exactly they could do in engineering…what some examples of various jobs are in the field.” These websites were included: SWE (Society of Women Engineers), http://societyofwomenengineers.swe.org/; Engineering Girl (The National Academy of Sciences), http://www.engineergirl.org/; Women Engineer Magazine (Equal Opportunity Publications, Inc.), http://www.eop.com/we.html; and ASEE EngineeringK12 Center (American Society for Engineering Education), http://www.egfi-k12.org/.

Post 2007 Session Evaluation

The following adaptations from the first year were considered:

<table>
<thead>
<tr>
<th>2007 SEE</th>
<th>Session Plan</th>
<th>Self-Evaluation</th>
<th>Future Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Handouts</td>
<td>Folder with handouts passed out at beginning of session.</td>
<td>Handouts are especially appropriate at sessions that do not have a lot of time for instruction.</td>
<td>Provide “Seven Steps of Research Process” and other relevant documents in print form or via website.</td>
</tr>
<tr>
<td>Research Locations</td>
<td>Tour of the Engineering &amp; Science Library.</td>
<td>Decided at the last minute not to do a tour. Is a tour really necessary? SEE students expected to use computer clusters or home computer. Knowing topics in advance is more important than classroom setting.</td>
<td>Discuss with SEE students how they use their local library—school or public. Ask their opinion about going to a library for information. Provide an activity to promote research skill building.</td>
</tr>
<tr>
<td>Library Catalog</td>
<td>Demonstration of searching library catalog, using keywords or subject headings.</td>
<td>Do the SEE students realize what item records represent in an online catalog?</td>
<td>Demonstrate with a public library catalog—not a university library catalog. Bring in age appropriate public library books related to their topics for their use during research sessions.</td>
</tr>
</tbody>
</table>
### Online Encyclopedia

Provide link to *AccessScience* and take the Energy quiz.  

Study guides are good to show. Use the SEE students’ chosen topics as examples when illustrating searches in *AccessScience*.

Continue to use *AccessScience*—a relevant proprietary resource that they can use while at Carnegie Mellon. Have SEE students do their own searching in *AccessScience* immediately following discussion of the tool.

### Database Selection

Provide a definition of a database. Compare to FBI fingerprint database (a commonly recognizable pop culture item). Show off a print journal.

Asking the SEE students to define “database” is a good way to promote critical thinking. Spend more time with the public library’s free databases.

Do not recommend *MetaLib*; too high-level for the SEE students; hard to find appropriate full-text. Do not recommend *Applied Science and Technology Full Text* without further review of appropriateness.

### Website Selection

View librarian selected websites on energy, doe.gov, etc.

Provide a colorful handout of suggested questions to ask when evaluating a website.

Spend additional time doing hands-on searching with teams of students and instructors.

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**Year Two – 2008**

All involved in the program were optimistic about improvements for the second year, scheduled for the two-week period, Monday, July 14, 2008 to Friday, July 25, 2008. In early spring 2008, the Principal Librarian took on a field placement student (Intern) from the University of Pittsburgh’s MLIS program that had a background as a middle school teacher and was interested in academic library experience. The Intern would prove invaluable for helping to address the concerns brought forth from the first year regarding age appropriate research resources. Lecture segments were planned to be interspersed with increased hands-on research experiences.

Librarians initiate contact

Several months in advance of the program, the SEE Faculty Advisor was contacted to ascertain if the library could assist with the information instruction for the 2008 SEE program. The librarians were all eager to build upon their assistance in the research element of the previous year. All were in agreement that breaking up the research section into a more hands-on experience was a better use of the SEE students’ time. Knowing
the SEE students’ topics ahead of time would also greatly facilitate helping them with their research, especially in choosing authoritative, yet appropriate resources.

The Faculty Advisor’s email response was positive about increasing the library research and presentation portions of the program. She welcomed the librarians to attend some of the planning meetings and the convener added the librarians to the formal planning group email notices. The Principal Librarian attended a few meetings and was able to successfully attest to the benefit of embedding the librarians throughout the workshop schedule.

Preparing for the session

Unlike the previous year, the librarians had a lot more time to organize. A website specifically geared to the SEE students’ research work was created: http://www.andrew.cmu.edu/user/lberard/SEE2008.html and collaboration also began with the Intern in anticipation of the July 2008 session.

Assessments were made about some of the resources that were used in the first year. Some of the websites viewed favorably in 2007 were proposed for the second year, most notably from the U.S. Army Corps of Engineers Education Center and the U.S. Department of Energy. The Intern found some additional relevant websites to share for the second year’s session and compiled a list:

<table>
<thead>
<tr>
<th>Resource</th>
<th>Relevant Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>AccessScience</td>
<td>Easy to navigate, articles broken down into sub-topics, vocabulary suitable for grade levels, good Q &amp; A and study center feature.</td>
</tr>
<tr>
<td>MetaLib</td>
<td>Participants may be overwhelmed with number of articles in both the General and Engineering &amp; Technology categories when using basic keyword search. Vocabulary is more suitable for college students.</td>
</tr>
<tr>
<td>(Carnegie Mellon’s federated search product)</td>
<td></td>
</tr>
<tr>
<td>“Education Center, Student Links to Government Energy Information”</td>
<td>Consists of a basic list of websites about different fields of engineering. The teacher resource tab has some good links to environmental topics.</td>
</tr>
<tr>
<td><a href="http://engineeringedu.com/students.html">http://engineeringedu.com/students.html</a></td>
<td></td>
</tr>
<tr>
<td>U.S. Army Corps of Engineers Education Center</td>
<td>Provides a thorough list of sites – after linking, type topic in search box if possible.</td>
</tr>
<tr>
<td>First Gov for Kids</td>
<td>Categorized for grade level, links to careers provided, site of month feature.</td>
</tr>
<tr>
<td>NASA Just for Kids</td>
<td>Comprehensive site, career page, affiliation with World Book Encyclopedia with topic links.</td>
</tr>
<tr>
<td><a href="http://www.nasa.gov/home/index.html">http://www.nasa.gov/home/index.html</a></td>
<td></td>
</tr>
</tbody>
</table>
Defined Objectives

The Intern also helped the librarians to define priorities. The objectives of the workshop were depicted on the research website and included goals:

- To develop participant awareness and understanding of select academic databases and to familiarize them with efficient search strategies in order to complete a mini research project.
- To promote and foster the importance of authoritative online information.
- To present the basic steps of effective research writing.
- To present proper citation methods of documenting sources.

The session was designed to introduce the basic elements and search techniques of academic databases in order to find sufficient information for a mini research project as part of the summer program introduction to the field of engineering. Unlike the first year, a layout for instruction was formulated. Nevertheless, the librarians did not want the SEE students to be deprived of spontaneous opportunities to ask questions with sessions that were too focused on formal expectations.

It was assumed that during the first week’s session, participants had been introduced to the different areas of engineering and had been informed of the expectations and requirements of the program. By the time of the research workshop session, participants had selected their topics. It was also assumed that participants had basic computer skills and experience using Microsoft Word and PowerPoint.

The participants entering grades 8-9, interested in the field of engineering, were a very important consideration when developing the lesson plan for the library instructional portion. Tailoring the information for their academic level was imperative for two
reasons: It had to be clear and logical (understandable) and teen user friendly, and be presented within a window of time to support their attention span.

Survey of the participants

Another advantage for the librarians was access to the results of a Pre-Program Survey administered to the SEE students on the program’s first day. A brief summary of the results of the pre-test revealed that the majority understood what engineers do, but they did not know if they would decide to study engineering in college. They answered correctly that burning coal is a source of emissions. However, they also had an indistinct idea of types of energy, such as kinetic, potential, electrical, and mechanical and did not know how to define a fuel cell, LED, or nanoparticle. Equipped with this background information, the librarians had a week’s time to tweak their presentation for the SEE students. They were able to better point them to introductory resources on the topics. Having this background information will continue to payoff as the instructors look ahead with plans for the fourth program year.

Session day

The librarians presented on the Monday of the second week. The handouts given at the beginning of the session included the Intern’s slides, text and link to the website, the “Seven Steps of the Research Process,” and a handout listing helpful “Transition or Linking words,” along with an “Outline” template to help with structuring presentations. The two hour session was divided into timed steps. After introductions were made and the SEE students logged into the computers, the first half of the session was allotted to getting basic background information on their topics. Librarians wanted to make suggestions for refining the topics before extended research was conducted. AccessScience was introduced and the tutorial was pointed out. Library catalogs, both the University and the local public library were shown for the purposes of finding books, including online texts. The librarians definitely wanted to allow the SEE students enough time to find Internet resources by exploring assigned sites. After presentations on how to properly cite their findings, the second half of the session was devoted to hands-on searching, with the librarians remaining present for individual help.

Learning AccessScience

Before the hands-on portion in order to start the SEE students thinking about where to find information on their topics, an introduction was made to databases: catalogs and encyclopedias. Like the first year, AccessScience was introduced as a beginning source for background information. They were also encouraged to think of alternative ways of stating their topics. For instance, “hybrid car” can be searched as “electric vehicles,” “hybrid electric vehicles,” “electric car,” etc.

One SEE student posed the research topic, “How do biomedical engineers make living skin tissue?” The Engineering Librarian suggested the term “tissue engineering” as a
way to find information on the topic that she would not have encountered through her “living skin tissue” phrase search.

AccessScience was explored as a way to help with another question, “How does electricity get to the outlets in our house?” First, a search in Google was demonstrated using the keyword “electricity,” retrieving over 70 million hits, with some on the first page likely relevant. However, the same search in AccessScience provided an encyclopedia entry that divided the topic into subheadings. AccessScience ranks results by providing exact and semantic word matches to their encyclopedia articles. Because of the simple layout to essay topics, the SEE students could quickly find clickable links to other words, such as “electric field”. The instructor then made the point that if the search results were unsatisfactory, they should go back to part two of the first step of the research process: “Develop Your Topic” by asking themselves: What do you want to find out about the electricity? What is another way to say “get to an outlet?” What do you think about using the words “transmit to” or “transmission? Can you think of other words or where to find other words to ask your questions?”

To further prove the utility of AccessScience, another question was used, “How is ethanol used as energy?” The SEE students were instructed to keep in mind that sometimes “less is more.” When considering their questions, they should pick out the important word(s), in this case, search “ethanol” rather than “ethanol used as energy.”

For this year, the librarian instructors used actual topics chosen by the SEE students to demonstrate searches, an improvement upon the previous year when the librarians chose their own example topics. 2008 questions included a range of topics such as “What is the effect of hybrids on the environment?” “How is ethanol used as energy?” “How do demolition engineers implode a building?” The SEE students benefitted from the use of their topics right from the start. Even though not as structured as she would have liked, the Faculty Advisor stated that she “let the girls choose questions for which they wanted to know the answer.” The ultimate goal for future SEE programs is to continue to work towards the right level questions for the SEE students’ education abilities by guiding them early on in the program towards information-manageable topics. As an example, an interest in such a broad concept as global warming would need to be reduced to a particular aspect so as not to be overwhelming due to the extensive and varied amount of literature about it. Conversely, if an inquiry is too narrow or not enough research is available, then certainly the SEE students, as well as, the instructors would not find adequate information for purposes of studying the issue. If information is difficult to find on their particular questions, the SEE students could become frustrated and potentially turned off to engineering research—quite the opposite hope of the program.

As the students were preparing to work independently at their computers, the lecture part of the research instruction ended on a fun note when the SEE students were asked if they had heard of the energy efficient sister to Google—known as Blackle and found at http://www.blackle.com/.

The Intern identified distinct expectations from the second year’s format:
- Introduced young students to library databases
- Hopefully helped develop an understanding of authoritative information
- Demonstrated effectiveness/accuracy vs. some “Google” information sites
- One-on-one instruction
- Importance of proper citations
- Reinforce basic plagiarism principles
- Practical tips for technical research writing
- Online demos of databases

In general the librarians felt that the SEE students were not focused during the lecture segment of the session. Many were inattentive during database and other instruction; they were searching on Yahoo email or Facebook. Some of them were continuing to search Google to find sources, not bothering to look at the suggested databases or sites. Not all the participants had a firm topic and some of the topics were too broad making it difficult for librarians to help them search for information. The demos were also bypassed perhaps because they were not a required resource for completing their project and/or the perception of “googling” was easier. Hence, the librarians felt they needed to consider ways to prevent inattention in future programs by splitting the research time into multiple mini sessions and utilizing other classroom hints; such as, preventing the SEE students from logging into the computers until the hands-on portion. More face-to-face collaboration with other professors participating as SEE program instructors would also better tailor the research component to complement their instruction efforts.

At the program’s conclusion, the Intern wrote a report describing her role in assisting with the website development and covering the subjects of information literacy and language arts/basic research writing. She shared her enthusiasm for the Camtasia software as a valuable tool for purposes of recording a tutorial to instruct the students on how to access and use particular resources. These tutorials could be accessed at the students’ convenience with the intention that they could learn at their own pace. The Intern also prepared PowerPoint presentations on paragraph and composition development and proper bibliographic citations.

The following table gives a further accounting of the lessons learned from the second year:

### Table 2 Evaluation Year 2

<table>
<thead>
<tr>
<th>2008 SEE</th>
<th>Session Plan</th>
<th>Self-Evaluation</th>
<th>Future Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pre-Planning</strong></td>
<td>Months before start of the program, the Principal Librarian met with Faculty Advisor and ICES faculty.</td>
<td>Librarians should continue to be included in planning stages.</td>
<td>Prepare handouts in advance for SEE Workbook binder handed to the SEE students on the first day of the program.</td>
</tr>
<tr>
<td><strong>Website Content</strong></td>
<td><strong>Handouts</strong></td>
<td><strong>Databases</strong></td>
<td><strong>Writing Hints</strong></td>
</tr>
<tr>
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</tr>
<tr>
<td>Research website is created, featuring live demos of select databases, website suggestions, how to evaluate websites, tips on project writing and citing sources.</td>
<td>Folder with handouts distributed.</td>
<td>Solicited discussion about databases and encyclopedias. Introduction to <em>AccessScience</em> as a resource for their project topics.</td>
<td>Showed how to cite using MLA formatting and provided guides for paragraph and composition development.</td>
</tr>
<tr>
<td>Create a site that is less wordy and includes images. Are the SEE students going to really need all the detailed information currently provided?</td>
<td>Is information provided too much “overload” for purposes of preparing for final presentation?</td>
<td>Continue to promote <em>AccessScience</em>. Continue to use actual topics as search examples.</td>
<td>While valuable, detailed grammar and writing style lessons were beyond the scope of the session.</td>
</tr>
<tr>
<td>Include revised Research website on main SEE webpage.</td>
<td>Condense info about how to write and cite into core bullet points. Continue to include access to “Seven Steps of Research Process.”</td>
<td>Have more hands-on with <em>AccessScience</em> early on in the sessions or immediately after discussion about it.</td>
<td>Direct students to website for those needing additional writing hints. Continue to provide basic MLA citation examples.</td>
</tr>
</tbody>
</table>

**Year Three – 2009**

In the summer of 2009, librarians were asked once again by the SEE program Faculty Advisor to take the lead in preparing the research component session. Twenty-three girls were chosen to participate, an increase of four from the previous year. Since the previous year, the Principal Librarian was included in all planning notices and the planning stage meetings with other faculty and members of the SEE program team. The team set up an initial schedule and discussed applicants. To be a more beneficial research mentor, the argument was made for increased librarian participation, with chances to meet with the
SEE students in shorter hands-on sessions, instead of lecture sessions. More sessions would allow for time to absorb and then to build upon newly learned research skills. The Faculty Advisor was able to provide a summary of some of the research questions that the SEE students were considering. Since a two week program was limiting in the time allotted to research a new topic, knowing the questions ahead of time would allow the librarians to spend some of their own time seeking out appropriate resources. The librarians felt that their contributions to the program had evolved considerably from the first two years particularly since their input was influential in programming meetings.

Preparation

After the first day of the program, all the SEE instructors, including the librarians were provided with the results of a knowledge pretest that was administered to the SEE students. The Faculty Advisor summarized the answers in an email sent to all of the instructors, advising that the SEE students work included studying units, learning that energy is measured in Joules.

This summary helped the librarians choose age appropriate resources that would offer basic definitions and explanations of energy related terms. The partial list of the chosen research topics was also more complete by the end of the first workshop’s day. The Faculty Advisor provided that list to the SEE instructors as well. The subjects ranged from “How do fireworks work?” to “How does Florida use the ocean for air conditioning?” to “What are the energy/pollution consequences of the cosmetics industry?”

Many sessions

The library sessions were scheduled for periods when the girls would be working on their research projects. From a one-shot session held the first year, the librarians were now slated for involvement in four sessions, two the first week and two the second week. The Faculty Advisor was in favor of introducing the librarians early in the SEE program, but in previous years the Principal Librarian had professional commitments the first week and unfortunately this set in motion the misunderstanding that the second program week was best for the library staff as well as for the girls. During the year long planning meetings with teaching participants, the Principal Librarian did engage the faculty in a discussion of involving the librarians more often in the formal program but for a shorter time. Happily, this idea was favorably received, and a plan emerged to invite the librarians to present “fun-factoids and searching tips” rather than full-blown lengthy library lecture presentations. Presenting in this manner seemed to suit the audience as the girls began to share with the class ideas and websites they were familiar with when conducting research and writing papers for school projects. Student participation was engaging and all shared lively and instructive information. As students began to work solo to create their presentations, library staff roamed the lab assisting with technical questions and offering assistance with research strategy.
The librarian instructors were able to meet with the SEE students on the second day of the first week and immediately helped them to start researching their topics. Software that the SEE students had used at their schools for managing citations was discussed. This software included BibMe, http://www.bibme.org/, and also others that the University Librarians were unfamiliar with, such as NoodleTools, http://www.noodletools.com/, and KnightCite, http://www.calvin.edu/library/knightcite/. Even though they were unable to meet with them again for a second time that week, a mentoring relationship with the librarians was started early on. Updated from the previous year, the SEE students furthermore had the website as a guide: http://www.andrew.cmu.edu/user/lberard/SEE2009.html.

Stepping up to teach

The remaining two sessions were planned for Monday and Thursday of the second week. The Intern that had participated the previous year and during week one of this session was asked to help again. The Intern solicited extra assistance from her classmate, another MLIS student (an experienced middle-school teacher). The Engineering Librarian was grateful to have the two MLIS students especially since she had not expected to have a teaching role in the second year. She searched the Library’s catalog to see if she could find any related books on the SEE students’ topics. She found books from the University’s Engineering and Science Library on most of the topics and brought them to the session, informing the students that they could look at them during the hands-on portion. This was an opportunity to teach the SEE students the merits of finding information from a book devoted exclusively to their subject as opposed to website searching alone. With the limited time devoted to the hands-on session, however, the University Library texts could not be utilized. Plus, not a lot of evaluation was given in consideration of the books’ intended audiences. The librarians hope to incorporate suitable texts, either online books or possibly books from the nearby public library, into future SEE programs.

The Faculty Advisor created a guideline that permitted the SEE students to explore .edu and .gov websites exclusively. Suggestions were given on where to find images for their presentations. As a “take-away” from this second session, copies of the “Pick a Major” handout from ENGINEERING GO FOR IT! https://engineering.purdue.edu/EPICSHS/Teachers/Summer/Documents/Engineering%20Careers.pdf, were distributed. This ASEE publication gives a short summary on different types of engineering.

During the final session, a part-time Information Assistant for the University’s Science Libraries was recruited to help out since the Intern and the other MLIS student from the previous week were unavailable. The expectation was that girls’ research would have been completed at this point. At this session, the Faculty Advisor gave instructions for formatting the SEE students’ PowerPoint presentations during a two-hour hands-on session. She wanted the SEE students to concentrate on five major slides: introduction (your question), background information necessary to understand the question and the answer, results, conclusions and works cited.
Providing individual feedback

The computer lab was set-up in a way that forced the SEE students to have their backs to the instructors. In some ways, the librarians felt awkward about hovering over them. But, in another sense, the librarians found it easy to move around the room where needed and to encourage each student, even the individuals not asking questions, by showing interest in their work. The Engineering Librarian felt that her interactions with the SEE students at this session were very valuable in helping them to express themselves and their work. The instructors stimulated critical thinking by asking questions, such as: “What do you mean by this sentence? Do you think that someone in the back of the room will be able to see everything that you put on this slide? Where did you find out about this?—you need to list all your references; even if they do not fit on one slide, use an extra slide.” The librarian instructors wanted to be mindful of the varied abilities of the individual students. A middle school summer program in collaboration with IBM, called Exploring Interests in Technology and Engineering (EX.I.T.E) recognizes that, “…students are often not provided with the tools and skills needed to successfully manage projects, especially complex ones”.

Through exposure to mentors in the SEE program, including the librarians, the SEE students were able to practice some of these skills to see research through to a conclusion, in a structured, yet fun environment.

One of the students found an image that used animation in depicting the workings of a fuel cell. No one, including the librarian instructors could figure out how to copy the animation part of the image into the slide. To the amazement of the instructors, the SEE student proposed that she would make it work by somehow including her own description of the “flow.” Indeed, during her actual presentation, she described the animation part of the fuel cell image by pointing towards the up, down, and through movements. Perhaps if the animation could have been easily copied, her learning of the process would not have been as complete. Another SEE student asked the Generation X, youthful MLIS library student instructor if he was really a librarian. When he responded affirmatively, she then asked what librarians do all day. The Engineering Librarian that witnessed this interaction was taken aback because the librarians’ role was to assist in a program whose goal was to interest middle school girls towards a possible engineering career. Yet, it proved also an opportunity to positively portray the field of library and information science.

On the other hand, the instructors were disappointed to notice that some of the SEE students had resorted to citing information found in About.com and eHow.com. But, they were also resourceful in finding more credible sites on their own, such as HowStuffWorks.com.

Librarians’ impact

The mentoring role of the instructors during the hands-on portion of the session was instrumental in allowing the SEE students to express themselves with confidence. Selected participants were perceived to be more attentive and eager to use the ideas and
sources presented then in the previous two years. Most had a topic selected and had it narrowed. The librarians learned to prepare for sessions by highlighting only select resources, thereby removing the temptation to present overwhelming choices with online and printed handouts. By becoming as proficient as possible in the presentation software and the pre-chosen citation software, librarians position themselves as authentic mentors. Moreover, pinpointing and endorsing age appropriate science and engineering resources was core to the librarians’ approachability.

Collaborating with other non-librarian faculty will help to see that all the instructors are on the same page. The librarians did not know ahead of time how much instruction the SEE students had received in the past concerning citations or website evaluation. For future programs the librarians would like to recommend the addition of one or two research related questions to a pre-program survey or pretest. Librarians would like to also consider ways to more formally apply any applicable library standards for information literacy when planning subsequent sessions.

The following table describes results from the third year:

**Table 3 Evaluation Year 3**

<table>
<thead>
<tr>
<th>2009 SEE</th>
<th>Session Plan</th>
<th>Self-Evaluation</th>
<th>Future Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pre-Planning</strong></td>
<td>Pre-meetings with Faculty Advisor and other faculty.</td>
<td>Continue to offer feedback on the schedule and research sessions.</td>
<td>Continue to incorporate research sessions in both weeks of the program.</td>
</tr>
<tr>
<td><strong>Website and Handouts</strong></td>
<td>Development of website and handouts. Provided “Pick a Major” handout from ASEE’s publication, “Engineering GO FOR IT.”</td>
<td>“Don’t reinvent the wheel”—with the increase in the number of options for good handouts, provide select links on website. Still useful to provide printed handout.</td>
<td>Provide every student with latest edition of ASEE’s <em>Engineering GO FOR IT!</em> Magazine plus the “Dream Up the Future” poster. Continue to improve website. Link all websites created for SEE students thru main site.</td>
</tr>
<tr>
<td><strong>Library Books</strong></td>
<td>Books from Engineering and Science Library on energy topics related to their chosen topics.</td>
<td>Hard to absorb material from selected books at one session. Need to provide more age appropriate summaries of their topics.</td>
<td>Bring age appropriate public library books to first session.</td>
</tr>
</tbody>
</table>
Conclusion

In moving forward, University Engineering and Science Librarians can contribute in many ways to the success of a summer engineering experience program for girls. Like other University faculty, they should be acknowledged as stakeholders in movements to help girls become more empowered to consider careers in science and technology fields, especially in engineering. In particular, for the SEE program, the key is to take the improvements gained from each year and continue to develop them. Even though the program introduced a new venture, departing from the day-to-day mission of the University, the Engineering Librarians expanded their own library instruction program to include a younger audience. Activities around this new knowledge base allow for building a collection with more breadth and depth, addressing any level of engineering learning and adding supporting teaching materials for the faculty to utilize when planning programs. By sharing a common experience with other faculty, librarians become more invested in serving the engineering college, providing a unique teambuilding opportunity. This expanded liaison role embeds the librarians with a cross section of members from the engineering college community who have come together to contribute to society by encouraging engineering as a potential profession to grade school children.

Incorporating eager and talented library and information science interns also empowers them and our profession as a whole to consider the impact that we can make on the educational aspirations of young women. The librarians are energized by their evolving role in the program, working with a team of committed instructors, and they look forward to helping to create an even better experience for the next generation of SEE students by inspiring them to consider the engineering field as a career choice.
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Head, Engineering Design Research Lab,
ICES: Institute for Complex Engineered Systems
Carnegie Mellon University

Brandy Wyant
H&SS ’08
Carnegie Mellon University

References


## Appendix: Example SEE Schedule

(Librarian participation indicated in shaded blocks.)

### Summer Engineering Experience (SEE) July 2009

<table>
<thead>
<tr>
<th>Monday</th>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
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<td>10:00-12:15</td>
<td>10:00-12:15</td>
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<td>Energy Basics:</td>
<td>Energy Management</td>
<td>Climate Change &amp;</td>
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<td>Engineering</td>
<td>Units of Conversion</td>
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<td>Role of Energy</td>
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<td>12:15-12:45</td>
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<td>12:45-3:00</td>
<td>1:00-1:30</td>
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<td>Life Cycle Activity</td>
<td>Energy Research</td>
<td>Energy Management</td>
<td>Air Quality Control</td>
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<td>1:30-3:00</td>
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<td>Panel of women</td>
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<td>engineering</td>
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<td>1:00-2:00</td>
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