

Libraries Embrace the Engineering Grand Challenges

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The National Academy of Engineering has put forward 14 Grand Challenges for Engineering in the 21st Century. Students at participating universities address these through the Grand Challenge Scholars Program (GCSP). Each program is unique, approved by application to the NAE, designed and administered by faculty and staff at the participating institution. At our institution a Civil Engineering faculty member developed a proposal to participate, received the approval of the Dean of the College of Engineering, and submitted the proposal to NAE. Our participation was approved in 2014. Since that time, the faculty coordinator has been invited to join the NAE's National Steering Committee for the Grand Challenge Scholars Program, reviewing and approving proposals to establish GCSPs at other universities. Two University faculty and two students were invited to attend the Grand Challenges Summit held in Beijing, China in 2015.

Participating students at our institution are required to develop a research project around one of the Grand Challenges. They may take courses designed with the Grand Challenges in mind, or develop a project that applies subject knowledge. They must seek out opportunities to develop global perspectives, and participate in service learning projects. Our Engineering College web site sets out the program goals:

Research or Major Project

All GC Scholars will be required to initiate, complete and make a presentation on a research project related to one or more Grand Challenges.

Interdisciplinary Curriculum

GC Scholars will be required to complete a curriculum that provides knowledge related to solving one or more of the Grand Challenges. GCSP requirements are expected to fit within typical degree requirements and should not prevent a student from completing degree requirements within the normal four-year timeframe.

Global Perspective

GC Scholars will be required to complete a global awareness activity (ideally study abroad) in order to understand the global aspects of the problem they are trying to solve and the contextual challenges to implementing solutions.

In 2016 GC Scholars participated in a field trip to Iceland to study renewable energy, organized with GREEN (Global Energy Education Network). Engineering students at the University are encouraged to take a semester abroad, and some GC Scholars have been able to do so.

Service-Learning

All GC Scholars will be required to complete an approved service-learning experience that ideally will provide experiential learning and multicultural awareness. The Office of Civic Engagement is committed to helping GC Scholars identify meaningful service learning opportunities.

The Office of Civic Engagement is located in the Library, and a staff member is on the steering committee. The first cohort of GC Scholars participated in a Spring Break Appalachian Service Project trip, sponsored by an Engineering alumnus. Students and staff both participate in trips to New Orleans for Hurricane Sandy recovery efforts, and annual Brigade trips to Nueva Vida, Nicaragua, building infrastructure for that community. Photos from this last service trip were included in *ASEE Prism*.

Entrepreneurship Experience

All GC Scholars will be required to complete some form of entrepreneurial activity, whether related to a for-profit venture or a social entrepreneurship activity.

Some opportunities for engineering students are created by our Small Business Development Center, working with local industries. SMBC also offers seminars on entrepreneurship, business, and intellectual property (an obvious opportunity for Library collaboration). A KEEN grant from the Kern Entrepreneurial Education Network supported the KEEN Winter Interdisciplinary Design Experience, a “business pitch” competition. Students used Library & IT services and equipment to prepare their presentations.

Librarian participation

At our university, a steering committee of faculty and staff from the College of Engineering, the College of Arts & Sciences, the Office of Civic Engagement, Library & Information Technology, and the Career Development Center all collaborate to provide GCSP students with special educational opportunities. The Librarian for Engineering Resources serves on the advisory committees for specific scholars. Familiarity with the program facilitates the development of library collections and resources that support research. The librarian serving on the Engineering Grand Challenges steering committee helps review student applications to join the program, and serves on some of the advisory panels, which are assigned to individual students. The librarian helped design a promotional / recruitment flyer sent to all engineering students.

The willingness of the faculty administering our GCSP to include staff members as partners, and the availability of the engineering librarian to participate in and promote the program, have made this a successful collaboration. As our university adds new students to the cohort each year, we are building from 11 to 60 student participants, and finding that the library components of the program are easily scalable.

The librarian has also been an active advocate for the GCSP program of our institution, presenting and reporting on our activities at regional conferences and workshops. The librarian presented on the University’s GCSP at the Union College Engineering and Liberal Education Symposium, at the ASEE Northeast Regional Meeting, and at ASEE Annual Conference.

The NAE’s GCSP program creates opportunities for librarians to collaborate with faculty and administrators, to serve on university-wide committees, to work directly with student scholars, and to promote research into the solutions to these pressing engineering challenges.

Library support for GCSP

A Research Guide developed in LibGuides is dedicated to the GCSP, and highlights information resources. The Research Guide points to specific resources for each challenge, and serves as a starting point for library instruction. The Research Guide supported a first year Foundation Seminar and a Residential College course. In the first year of the program, Library & IT staff worked with students to

develop a GCSP Wiki. Going forward, the development of an interactive course management page or WordPress blog managed by the library has been proposed.

Library collections and resources support research on the Grand Challenges. Traditional database platforms such as Engineering Village, ScienceDirect, and PubMed do a great job of discovery and providing access. Our scholars need to broaden their searches for some topics to include everything from economics to neuroscience. Full-text resources including Knovel Digital Library, McGraw-Hill Access Engineering, SpringerLink, and Synthesis feature useful reference titles. Specialized resources for specific topics such as “improving urban infrastructure” might include GreenR and GreenFILE, the BuildingGreen Suite, and the NAE website. The library provides information resources support for students studying abroad, including network access for databases and full-text resources, interlibrary loan and document delivery, and online research consultations. The librarian has devoted collection development resources specifically to support the GC Scholars.

Going Forward

As our GCSP students approach graduation, they are required to report on their achievements and experiences in the Grand Challenges program. All GCSP participants and the steering committee members attend an annual reception that includes poster sessions and power point presentations, highlighting the seniors’ projects and research. Undergraduates are encouraged to hear of the variety of ways that the GCSP requirements and interdisciplinary research can be achieved within the engineering college curriculum. As we “check the boxes” on the requirements noted above, it is clear that there are additional ways that students’ participation could be assessed and feedback solicited. From a librarian’s perspective, student research could include cited resource requirements. Other simple assessment instruments could be developed for the advisory panels working with individual students. And as our cohort grows, we should consider additional coordination with groups of students working on the same Grand Challenge.

Furthur Reading

Grose, Thomas K. (2014), “Millenial Magnet: the Grand Challenge Scholars Program reaches cruising speed, attracting the altruistic, the entrepreneurial, and the bored.” *ASEE Prism* 24:2, p.24-35.

Olson, S., National Academy of Engineering, & Prospects, and Priorities (Forum). (2016). *Grand Challenges for engineering : Imperatives, prospects, and priorities : summary of a forum.* Washington, D.C.: National Academies Press.

Ramakrishna, B.L. (2017) “NAE Grand Challenges for Engineering”
<http://www.engineeringchallenges.org/14365/GrandChallengeScholarsProgram.aspx> Retrieved 03/07/2017.