



National Academy of Engineering - Grand Challenge Scholars Program

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Vision and Goals

The vision for the UVA Grand Challenge Scholars Program is to help students from **all majors** prepare themselves to shape the world for the better through design and engineering. Our direct goal is to graduate at least 20 Scholars per year who have worked with each other and with faculty mentors to develop and execute a plan tailored to pursuing a Grand Challenge for the 21st century, including those outlined by NAE, and also those identified by students and approved by the steering committee. An indirect goal is for the Scholars program to help with an ongoing shift at UVA from organization solely around disciplines to organization around shared challenges.

Unique Aspects

UVA's Engineering School has a rich history as the fourth oldest engineering school in the U.S. The School of approximately 2,700 students uniquely combines undergraduate research and educational opportunities as part of a consistently top-ranked public institution. For example, courses in engineering, ethics, mathematics, the sciences, and the humanities are available to build a strong foundation for careers in engineering and other professions. Abundant research opportunities include a required undergraduate thesis project for all engineering majors that is facilitated by the School's unique Engineering and Society Department¹ in collaboration with the technical faculty.

An important feature of our program will be concerted effort to involve students from non-engineering majors through UVA's OpenGrounds initiative. Additional details about how we will pursue this goal as well as the basic program requirements are provided below.

Funding and support

¹ <http://www.eands.virginia.edu/>

The School is committed to funding the logistical costs associated with the program (travel to GCSP events, meals, guest speakers, marketing efforts). It is also our intent that any student who is selected as a Scholar will not face financial barriers to completing the program. As described in the program requirements, many of the activities (e.g., research experiences, interdisciplinary curriculum, entrepreneurship, and service opportunities) have no additional cost to the Scholar. In cases where additional costs may be incurred by Scholars, such as for travel to study abroad, for non-curricular activities related to entrepreneurship, or materials for service projects, the GCSP director and mentors will work with Scholars to identify funding sources. If there is no funding available from these other channels, the School will consider paying these costs for Scholars in good standing. Note that this is how Dr. Klotz ran the GCSP program at Clemson and the total additional costs were under \$5,000 per year.

PROGRAM REQUIREMENTS

1 Research experience

Learning outcome: Scholars will make significant progress on inquiry related to their Grand Challenge; and present their findings in a professional and engaging manner.

Minimum requirements to achieve this learning outcome are that Scholars will:

1. Complete the equivalent of 3 credit hours of inquiry related to their Grand Challenge.
2. Produce a written report describing their inquiry. This report should be written in the format appropriate for a selected journal or conference publication, or the equivalent. An initial draft report must be revised based on feedback from the mentor and from another Scholar. The improved report must be submitted to at least one external peer reviewer and revised based on her feedback. External peer review may occur as part of a journal article or conference paper review process.
3. Prepare and deliver a 10-minute TED-style presentation describing Scholars' work to a general audience.
4. Mentor (primary) and peer scholar (secondary) assessment will be used to determine that the work is equivalent to 3 credit hours, that written report is suitable for external peer review, and that the presentation has been delivered.

Example research experience activities (note, we have attempted to provide examples for engineering students and non-engineering students. Additional specific examples will be added as Scholars identify these alternative paths.)

- Undergraduate thesis
- Independent design research studio
- Approved external research and inquiry experiences such as internships and co-ops through which participants satisfy all 3 tasks listed above

2 Interdisciplinary curriculum

Learning outcome: Scholars will complete coursework outside of their primary discipline that is related to their Grand Challenge.

To achieve this learning outcome, Scholars will:

1. Complete 6 credits of coursework related to their Grand Challenge but **not** required by their major. The intent of this requirement is for Scholars to expand their intellectual horizons and expose themselves to a wider range of worldviews. In this spirit, 3 credits of this requirement may be satisfied through independent study credit earned outside of the Scholar's major. Before the proposed courses are approved, students must justify why their selected courses are different from what would normally be taken in their major, and also how their selected courses advance their ability to work on their Grand Challenge.
2. Show connections between this coursework and their research in the presentation described in #3 of the research experience section.

Example interdisciplinary curriculum activities

- Courses related to Grand Challenges (outside of the Scholar's major)
- Policy, ethics, leadership, and humanities and social science courses, including those offered through the Department of Engineering and Society.
- Completion of the Washington Policy Internship Program.
- Independent study credit for participation in non-major activities related to Grand Challenges

3 Entrepreneurship

Learning outcome: Scholars will practice taking steps from idea to implementation (including for social entrepreneurship).

To achieve this learning outcome, Scholars will **either**:

1. Complete at least 3 credits of coursework in entrepreneurship; **or**
2. Incorporate a significant (equivalent to at least 3 credits of effort) entrepreneurship component in their Grand Challenge research experience.

Example entrepreneurship activities

- Courses such as those offered through the Entrepreneurship Minor (e.g., courses in the STS 2800 series).
- Creating a business model related to their Grand Challenge research experience.
- Developing a physical product prototype related to their Grand Challenge research experience.
- Completing a market analysis related to their Grand Challenge research experience.

- Applying for a patent related to their Grand Challenge research experience (perhaps facilitated through STS 1500 where students learn to write preliminary patent applications).
- Soliciting funding to support their Grand Challenge research experience through grant proposals and presentations to donors.
- Competing successfully in entrepreneurship competitions.

4 Global dimension

Learning outcome: Scholars will develop their global perspective and demonstrate application of this perspective.

To achieve this learning outcome, Scholars will **either**:

1. Study abroad (may be a full semester, or summer or winter sessions) and show connections between this experience and their Grand Challenge in the presentation described in #3 of the research experience section; **or**
2. Complete at least 3 credits of coursework selected to develop their global perspective related to their Grand Challenge; **and** incorporate a significant (equivalent to at least 3 credits of effort) global dimension in their Grand Challenge research experience.

Example global dimension activities

- Courses such as those offered in the four tracks of the Global Studies major.
- Courses in cross-cultural engineering (such as STS 2500).
- Study abroad, including the many opportunities available through UVA International Programs².
- Meaningful participation in international service organizations such as Engineers without Borders and similar groups.

5 Service learning

Learning outcome: Scholars will apply their unique skills to societal problems at the local scale.

To achieve this learning outcome, Scholars will:

1. Participate in at least 30 hours of local service related to their Grand Challenge. The Scholar should strive to maximize the benefit of the time they will spend. Picking up trash, for example, may be useful, but not as much as starting a program to reduce litter in the first place. This service may occur on campus, in the community surrounding UVA, or in the Scholars' hometown.

² <https://iso.virginia.edu/>

2. Relate their service experience to a Grand Challenge as part of their presentation described in #3 of the research experience section.

Example service learning activities

- Incorporating a local service component in their Grand Challenge research experience.
- Tutoring and mentoring other students, including K-12 outreach such as use of UVA's engineering kits³ for this purpose.
- Participation in community design-build projects such as Habitat for Humanity and Engineers without Borders.

PROGRAM ADMINISTRATION

Scholar recruitment, application, and selection

- Students will be recruited via e-mail from the Provost to students in **all majors** during the second semester of their first year at UVA. To avoid perceptions that the program is exclusively for engineering majors, the program will be facilitated through UVA's pan-university "opengrounds" initiative, which exists so that the diverse richness of talent at the university can collaborate on those societal challenges most in need of fresh thinking⁴. Opengrounds is a recognized discipline-neutral organization and also offers collaborative physical space. Targeted recruiting will also occur via faculty engaged in research related to Grand Challenges, programs intended to reach underrepresented groups⁵, the Rodman Scholars⁶ and Jefferson Scholars⁷ honors programs, and especially word-of-mouth from Scholars themselves.
- UVA students who have completed at least one semester of study and have at least a 3.0 GPA are eligible to apply for the program. Selected students will officially begin the program in the fall of their second year at UVA (exceptions will be made for unusual degree progress circumstances).
- Interested students should submit (1) their preliminary plan of study in the format below, (2) a statement (250 words maximum) explaining why they want to be a Scholar, and (3) a current resume.
- Scholars will eventually select a mentor faculty member, but this is not a requirement for initial acceptance into the program.
- A panel of mentors and Scholars will review applications and select new Scholars. We anticipate selecting around 30 Scholars each year.

³ <http://www.seas.virginia.edu/events/k12.php>

⁴ <http://opengrounds.virginia.edu/>

⁵ <http://www.seas.virginia.edu/admin/diversity/undergrad/studgroups.php>

⁶ <http://seas.virginia.edu/students/rodmans/>

⁷ <http://www.jeffersonscholars.org/scholarship>

Scholar responsibilities and **assessment**

- Scholars are expected to make a good-faith effort to contribute to the program through activities such as providing feedback to their peers, attending peer presentations, and serving on application review panels.
- Scholars must maintain a 3.0 GPA and continue to make acceptable progress in the program.
- Scholar progress will be assessed based on the preliminary plan and the learning outcomes for each program area. Measures for this assessment will include deliverables such as the research report, completion of coursework and other activities, annual mentor feedback, and ultimately, an online blog post (<500 words) for the UVA GCS website in which the student reflects on how they achieved each of the learning outcomes.

Program logistics and **recognition** (for Scholars)

- Scholars will be recognized at UVA as part of an annual Grand Challenges symposium at the conclusion of their program. Scholars will also be recognized in the graduation programs of the University and School. We will also seek input from Scholars on other forms of recognition that they would find motivating.
- Coursework may not be double counted for more than one area of the program. For example, a 3-credit course in *Innovation Abroad* could satisfy either the Entrepreneurship or Global dimension areas, but not both.
- Scholars may work on similar topics as long as each completes the program components independently.

Program logistics and support (for **mentors**)

- Our steering committee will be facilitated by the GCSP director and comprised of faculty mentors representing each challenge with currently active Scholars. Steering committee members provide ongoing intellectual support and mentorship for Scholars in their challenge and in developing their plan of study, and for prospective applicants in applying to the program. Steering committee members receive peer-mentoring and mentoring from the GCSP director.
- Steering committee members will show 1) interest, 2) expertise in the challenge, and 3) demonstrated ability to mentor undergraduate students. In cases where there is more than one faculty interested and qualified for a specific challenge, we will increase the student enrollment accordingly, rather than exclude willing faculty. Steering committee faculty will be granted a course release or equivalent compensation for each three-years of service they provide.
- This program is designed to use existing UVA resources as much as possible. Faculty mentor participation will be considered in workload reporting as a contribution to teaching, research, and service responsibilities (whichever is most relevant for that faculty member).

1: Preliminary plan of study, template and example

Scholar: Ezra Chester

Grand Challenge: Improving Access to Clean Water

Program area	Planned activities
1 Research experience	-Implementation of water system in Haitian village through EWB -Documented results shared in a peer-reviewed journal
2 Interdisciplinary curriculum	-Organic Chemistry Coursework -Public and Environmental Health Coursework -Political Science classes
3 Entrepreneurship	-Formal grant submitted and received from EWB-USA -Market analysis of how communities can better afford water treatment systems
4 Global dimension	-Study Abroad in South Africa -Total of 8 months in Cange, Haiti as project manager -International Health Coursework
5 Service learning	-Volunteer at the Rosa Clark Medical Clinic -Work with EWB
Approvals	Mentor: Peer Scholar: Peer Scholar Mentor: