

Grand Challenges Scholars Program

University of Idaho

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Background and Vision

The vision of the Grand Challenge Scholars Program (GCSP) at the University of Idaho is to establish a model required to educate today's engineers. Each GC Scholar will focus on one of the four Grand Challenge themes or one of the 14 specific Grand Challenge problems. The GCSP is being launched as a decade long initiative through 2025 with the goal to graduate over 150 "Grand Challenge Engineers" from the UI who are prepared with the unique combination of skills, motivation, and leadership to address the Grand Challenges for Engineering of the 21st century.

NAE Grand Challenges of the 21st Century

The National Academy of Engineering has identified 14 Grand Challenges to enhance the areas of sustainability, security, health, and joy of living. <http://www.engineeringchallenges.org/>

Sustainability

Make solar energy economical
Provide energy from fusion
Develop carbon sequestration methods
Manage the nitrogen cycle
Provide access to clean water

Security

Restore and improve urban infrastructure
Prevent nuclear terror
Secure cyberspace

Health

Advance health informatics
Engineer better medicines

Joy of Living

Reverse-engineer the brain
Enhance virtual reality
Advance personalized learning
Engineer the tools of scientific discovery

In addition to gaining technical competence through their undergraduate education, the program enables students to experience five components that will broaden their education:

1. Creative learning experiences through research;
2. Hands-on, interdisciplinary learning experiences in non-technical fields;
3. Entrepreneurship and innovation experiences;
4. Global and cross-cultural perspectives;
5. Development of social consciousness through service-learning.

These five component of the GCSP will establish a model of the characteristics needed by tomorrow's engineer. Students will pursue these components through advising of existing coursework and extracurricular activities. There are numerous courses throughout the university that students can complete to gain experience in the five components such as Business 414 - Introduction to Entrepreneurship (3 cr). Likewise, there are many activities for

student engagement such as Engineers Without Borders or programs of the Idaho Entrepreneurs program. A list of suggested opportunities is provided later in this proposal. There are additional courses and activities at Washington State University (8 miles away) that can be used by student to pursue the five components. Additional opportunities will be created as the program evolves. With respect to these five components, we seek the desired outcomes of understanding, engagement, expertise, and leadership. We want students to understand the purpose of these five components, become engaged in the program, gain significant expertise the Grand Challenges, and develop themselves as a leader. We believe this program is designed to help achieve all of these outcomes.

All students at the University of Idaho are required to take two ISEM (Integrated Seminar) courses during their academic career, one during the freshman year and one during their sophomore/junior year. A Grand Challenge ISEM course is being developed and will be offered for the first time during the 2016-17 academic year. All GCS students will be requested to take it to meet their ISEM requirement and gain a more broad understanding of all of the Grand Challenges.

A Grand Challenge Council has been formed to support the students. The Council is comprised of volunteer members of the UI Academy of Engineers and an engineering faculty member, selected by the department Chair, from each of the six departments. We may also add staff members and alumni in the future as deemed necessary. Those members of the Council from the UI Academy of Engineering will be responsible to engage in at least two of the following five duties; faculty members will participate in duties 1-4:

1. Mentor a student(s)
2. Participate in GCS events such as the Fall Reception or presentations during Expo
3. Review the submitted GCS Plans and provide feedback
4. Review the submitted GCS Portfolios and provide feedback
5. UI Academy members will contribute financially to the program in support of stipends for the students

Through this program and interactions with members of the Council and others, students will gain experience in not only the technical content of the Grand Challenges but in the components of a broader education. We recognize that this program will require additional resources for sponsored events and to support the students as they execute their plans. In addition to the reallocation of staff time to support the GC Advisor and event support, we have been promoting this program with our donors to help support the students' pursuit of these activities and experiences. To date we have raised over \$100,000 in an endowment and are continuing to receive funds for this purpose. We have also secured over \$30,000 for startup support of this program and several UI Academy members have pledged on-going financial support for the duration of the program. We are confident, as the program gets established, that additional financial support will continue to be secured. There are also additional funding sources through other established programs at the university that our students can apply for, such as those through the Undergraduate Research Office and the Study Abroad Office.

How GC scholars will be selected

We plan to admit a maximum of 25 new students to the program each year. Our target student will be one towards the end of their freshman year and beginning of their sophomore year. We have a program called Engineering Scholars for our highest achieving incoming freshman and these students will be heavily recruited for the GCSP. We will also recruit engineering students from the Honors College but others will be considered if they have a plan where they can be successful and meet the requirements.

To begin the process of becoming a GC Scholar, students will be required to submit an online application indicating their interest in the GCSP. The application will serve as an initial screening requiring all GC Scholar Candidates to have at least a 3.0 GPA in college and suitable interest and motivation as judged by the GCSP Advisor and another member of the Council during an in-person interview. Students who meet the criteria will be invited to submit a plan of what they will do to meet the requirements of the GCSP. Plans may be modified throughout the program but must be approved by the GCSP Advisor and another member of the Council. Towards the completion of the program, students will submit a final portfolio upon completion of their program, no later than two months into their final semester, which will be reviewed by members of the GC Council and the GCSP Advisor. Portfolios will be evaluated according to the criteria of the Portfolio Assessment Rubric (Appendix A). Students who do not receive a passing score may resubmit once for reconsideration. The GSC Program is being launched as a decade long initiative through 2025 with the goal to graduate over 150 “Grand Challenge Engineers” from UI who are prepared with the unique combination of skills, motivation, and leadership to address the Grand Challenges for Engineering for the 21st Century.

How the five GC curricular components will be met

The GCSP program will require the completion of course work and activity participation in each of the five components. For each, students may complete coursework, and/or participate in an approved program. The depth of the experience will depend if the student is attempting to gain expertise or experience in the component area. In order to complete the program students must demonstrate *expertise* in at least one of the five components and *experience* in the others. Below are Component Criteria that students need to satisfy to gain expertise or experience related to four Grand Challenge areas or 14 Grand Challenge problems. Students may propose other courses and activities of similar significance to include in their plan. Each plan will be as unique as the students themselves. By requiring the plans be approved we will ensure quality of the experience and a high likelihood of success.

1. Creative learning experiences through research

Expertise:

- Complete at least two full semesters of active research on a project with a faculty member at the UI and be a co-author on a paper that has been submitted to a professional conference or journal.

Experience:

- Complete at least one semester of active research on a project and present/co-present results to a public or university audience.
- Attend a national or international professional conference for three days or more.
- Actively participate in a research focused reading group regarding one or more grand challenges for at least one semester.
- Complete a research focused directed study or special topics course for one semester.

2. Hands-on, interdisciplinary learning experiences in non-technical fields

Expertise:

- Complete six credits in the fine arts, humanities, or social sciences (beyond the Gen Ed courses already required for graduation), or business, law, or public policy.

Experience:

- Complete three credits of courses in the Honors College but outside of the COE.
- Complete an appropriately interdisciplinary junior ISEM course.
- Complete a senior seminar course from another college.
- Complete a non-technical learning experience sponsored by the UI that requires more than 50 hours of involvement.

3. Entrepreneurship and innovation experiences

Expertise: (Complete two or more of the following)

- Compete in Idaho Entrepreneurs Business Plan Competition
- Compete in Idaho Entrepreneurs Idaho Pitch Competition
- Complete three credits of coursework focused on innovation and entrepreneurship such as ME 452 TechVentures (3 cr), Business 414 - Introduction to Entrepreneurship (3 cr), or Business 415 - New Venture Creation (3 cr).
- Create a venture (for-profit or non-profit) which may be a service organization or a club.
- Work at a start-up or early stage venture that addresses a Grand Challenge topic (as long as the student is actively engaged in the entrepreneurial aspect of the venture).

Experience:

- Complete only one of the above listed activities.
- Attend two of the Idaho Entrepreneurs competitions and record your experience.
- Attend five of the Idaho Entrepreneurs Speaker presentations and record your experience.

4. Global and cross-cultural perspectives

Expertise:

- Spend at least one semester of internationally through the UI Study Abroad program.
- Work for at least two semesters at an internationally-minded program that is located domestically.
- Hold an officer position for at least three semesters in a student organization that is focused internationally related to one of the grand challenges.

Experience:

- Travel abroad for two weeks or more on a UI sponsored learning trip.
- Actively participate with Engineers Without Borders and work at least one year on a project having a global dimension.
- Complete an internationally-based study program for less than a semester.
- Complete 6 credits of a foreign language.

5. Development of social consciousness through service-learning

Expertise:

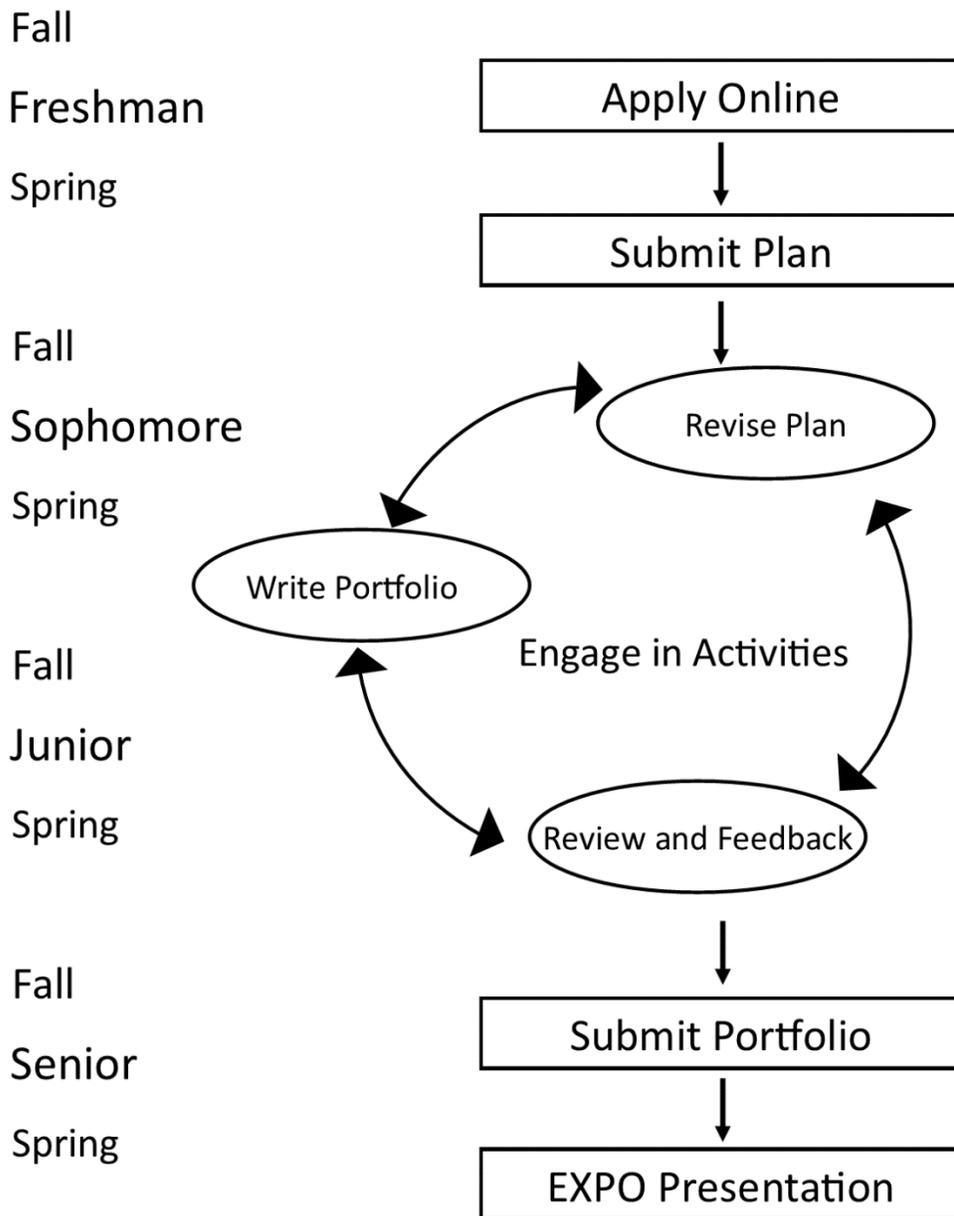
- Complete one two-week UI sponsored service learning trip or two one-week UI sponsored service learning trips.
- Demonstrate consistent, weekly or bi-weekly volunteerism with an organization outside of the COE for at least one semester.
- Plan and lead a significant service activity through one of the college's student societies.

Experience:

- Actively participate in one of the college's student societies for at least two semesters and participate in two or more of its service activities.
- Serve as a tutor for other students or K-12 students for two semesters.
- Volunteer with an organization outside of the COE on service activities for two or more semesters.
- Serve as a judge at a university or K-12 science or engineering fair (such as Invent Idaho) three or more times.

How GC scholars will be assessed and tracked

The initial screening will allow the college to track which students are interested in the program and which have been admitted. Students will meet with the Grand Challenge Advisor a minimum of once per semester to ensure they are on track to complete all requirements of the program. An engagement model is provided below:



Each student will make at least two presentations during their time as a GCSP participant. The first will be during the Fall Reception where they will be presenting their plan or status of their progress of their plan. Students will present at two or three Fall Receptions. The final presentation will be during our annual Engineering Expo the end of April each year. In this case they will be required to give a 10 minute presentation on their area of Expertise as well as submit a poster summarizing their accomplishments.

The Fall Reception will be hosted each October in conjunction with our Idaho Academy of Engineers induction ceremony. This event will serve several purposes. One will be for students to make a pitch for financial support. The dean and associate dean for undergraduates will determine the amount available for supporting the coming year's student activities before this fall event. Stipends (variable based on funding) will be awarded to the top students to support their plans such as for study abroad or research. This reception will also facilitate relationship building, the exchange of ideas, and an opportunity for mentoring by members of the GC Council and other Academy members. We will also promote this event as a way to introduce students to the GCSP and create excitement so that they will apply.

Completion of the program is contingent upon completing curricular and co-curricular activities as well as approval of the final portfolio that they will have completed to document they have achieved the desired outcomes of understanding, engagement, expertise, and leadership. The portfolio will contain a representation of the work that the student has completed and the activities they completed and events attended and is submitted at the beginning of the student's last semester. Students will also be required to write a reflection of these experiences to demonstrate that they understand how the five components are interconnected and align with the Grand Challenge they pursued. Also, they will be required to write a reflection of how they have developed as a leader through this program.

Appendix A Portfolio Assessment Rubric

Grand Challenge Assessment Rubric		Pass	Fail	Comment
Understanding	Description of the primary Grand Challenge area or problem	The student documented significant understanding of the purpose of the five components.	The student did not demonstrate and understanding of the purpose of the five components.	
Completeness	Five components	The student engaged in courses and activities in all five components	The student did not demonstrate engagement in one or more of the five components.	
Expertise	Primary component	The student has demonstrated significant expertise in at least one of the four grand challenge areas or one of the 14 grand challenge problems aligned with the courses and activities in their plan.	The student has demonstrated expertise in at least one of the four grand challenge areas or one of the 14 grand challenge problems aligned with the courses and activities in their plan but it is not as significant as outlined in the Component Criteria.	
Leadership	Description of their development as a leader	The student documented significant examples of how they have developed as a leader during this program.	The student failed to document any significant examples of how they have developed as a leader during this program.	