

Grand Challenges Scholars Program (GCSP) Application Instructions

On May 7, 2018, University of Dayton President Eric Spina invited over 100 faculty, staff, and students to explore how our university could contribute to the United Nation's Global Goals for 2030. University members from various areas on campus came together to bring the National Academy of Engineers' Grand Challenges Scholars Program to Dayton. GCSP Faculty and staff will mentor our scholars in completing the GCSP requirements and aligning them with their future careers.

What is required?

Scholars are required to create and complete a proposed plan of study for at least three upcoming semesters. Note that this is a proposal and that selections can be changed under the guidance of a GCSP Mentor and with approval of the Steering Committee. You may add previous experiences at the University of Dayton if you feel they meet any of the requirements listed in this application.

Why should I apply?

The Grand Challenges Scholars Program (GCSP) identifies 5 competencies that a student must achieve to prepare them to address the Grand Challenges for Engineering found globally. Addressing any of the Grand Challenges naturally spans multiple disciplines, and because Grand Challenge problem solutions are implemented in different parts of the world, students are prepared to think in international terms, and to develop globally relevant perspectives and skills. Anecdotally, the GCSP attracts students because it prepares them for real and urgent problems that need solutions; it is a basis for realistic experiments, homework and problem challenges in the field during their undergraduate years; and it offers a clear view to future jobs that matter and the opportunities in engineering that await them.

When should I apply?

Completing the GCSP requirements will take a minimum of three semesters to complete. It is suggested that second-semester freshmen and first-semester sophomores apply. However, many upperclassmen make excellent candidates due to experiences they have already completed prior to applying.

How do I apply?

Applications are submitted through a Google Form that is maintained by the GCSP Steering Committee. A proposed plan of study, admissions essay, transcript, resume, and optional list of references are all required to apply.

Contact Us

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National Academy of Engineering Grand Challenges

The Grand Challenges Scholars Program is an education supplement that adds global awareness and social skills with a focus on the Grand Challenges to broaden the reach of undergraduate studies to the global community. Scholars are required to select only one Grand Challenge.

Grand Challenges

Advance Healthcare Informatics

Approaches to health informatics enhance the quality and efficiency of medical care.

Advance Personalized Learning

Teaching methods that optimize learning for the diversity of individual preferences.

Develop Carbon Sequestration Methods

Capture and store excess carbon dioxide to prevent global warming.

Engineer Better Medicines

Develop new systems to provide health care directly tailored to each person.

Engineer the Tools of Scientific Discovery

Partner with scientists in the quest for exploring unanswered questions of nature.

Enhance Virtual Reality

Help train practitioners to treat patients or grow its various uses in entertainment.

Make Solar Energy Economical

Grow the use of solar energy to power more than 1 percent of the world's needs.

Manage the Nitrogen Cycle

Balance to the nitrogen cycle with better fertilization and recycling waste.

Prevent Nuclear Terror

The need for technologies to prevent and respond to a nuclear attack is growing.

Provide Access to Clean Water

The world's water supplies are threatening the lives of millions of people worldwide.

Provide Energy from Fusion

Scale up human-engineered fusion to commercial and environmental proportions.

Restore and Improve Urban Infrastructure

Modernize fundamental structures that support our civilization in centuries ahead.

Reverse Engineer the Brain

Impact artificial intelligence, health care, manufacturing, and communication.

Secure Cyberspace

Develop innovations for addressing a long list of cybersecurity priorities.

The 5 Competencies

Scholars complete the following five competencies at various levels of immersion when accepted into the program.

1. **Talent:** complete a mentored research experience on a Grand Challenge-like topic.
2. **Multicultural:** engage different cultures to understand impacts of engineering solutions.
3. **Multidisciplinary:** connect cross-disciplinary approaches to engineering systems solutions.
4. **Business/Entrepreneurship:** create a viable business model for implementation.
5. **Social Consciousness:** implement solutions that equitably serve people and society.

Review possible opportunities on the next pages to see how various university experiences can immerse your education in these competencies.

Completing the 5 Competencies

1. Talent Competency (high level of immersion):

This activity will involve either a research project or design development related to the student's selected Grand Challenge topic. It is expected to be at least a two-semester effort to ensure substantial output. Existing opportunities that can be leveraged to satisfy the talent competency include the following:

- Undergraduate research experiences sponsored by the Dean's offices, the Honors Program, and the Integrative Science and Engineering (ISE) Center Summer Collaborative Research Projects (CoRPS).
- Corporate Partnerships: Several companies that sponsor projects for our students through cooperative and internship employment, as well as sponsorship of capstone design projects.
- Air Force Research Laboratory (AFRL) and University of Dayton Research Institute (UDRI): UD's ties to the largest US-Department of Defense research complex is typically leveraged through the Southwestern Ohio Council of Higher Education (SOCHE) program and UDRI research contracts.

Students will need to satisfy this criteria through the following:

1. Involvement in a two-semester long research or creative design project directed or co-directed by the GCSP faculty mentor. Examples include:
 - a. Faculty-led research (e.g., NSF Research Experience for Undergraduates program or similar projects).
 - b. Honors project or honors thesis.
 - c. 2-semester capstone design project with heavy research component or substantial added background analysis.
 - d. 2-semester marketing project with the goal of increasing awareness of a specific Grand Challenge or promoting a potential intervention or solution developed by a GCSP team.
 - e. Cooperative/internship-based research-like project mentored jointly by faculty, and federal or industry collaborators.
2. Periodic presentations at GCSP meetings and inclusion of the results in their GCSP portfolio before graduation.
3. At least one of the following additional experiences:
 - a. Research showcased in a campus event like the Stander Symposium
 - b. Research included in a peer-reviewed publication
 - c. Research presented in a professional meeting
 - d. Research showcase at local chapters of professional societies
 - e. Applying for invention disclosure or patent

2. Multicultural Competency:

After completing this competency, the student will demonstrate in their portfolio their understanding and sensitivity to cultural issues among different communities (within the United States and across the globe), and how that is essential for viable Grand Challenge solutions. Here are some examples how students can satisfy different levels of immersion.

Low:

This will require a 3-credit hour course related to multicultural studies and connected to at least one of the Grand Challenges themes. This course could be a required common academic program (CAP) course in social science, faith traditions or practical ethical action depending on the actual content.

Medium and high:

These levels of immersion require foreign travel for international program participation, study abroad programs, international outreach initiatives, or a deep immersion into local collaborations for international initiatives. For students unwilling or unable to participate in these kinds of activities, only a low level of immersion is possible. Some international programs currently offered are listed below, and several others are available through NAE, local nonprofits and private foundations. Existing UD programs are:

- ETHOS (Engineers in Technical Humanitarian Opportunities of Service Learning) which provides service-learning experiences through technical immersions, student activities, research and hands-on projects.
- BWISE (Business Wisdom through International, Service and Experiential Education) program
- Study Abroad
 - Exchange Programs allow students to travel to UD partner institutions.
 - External Partner Programs offered by professional organizations which allow students to study for a summer, semester or an academic year.

The duration, type and intensity of these activities will be the principal determinant for which level of immersion it qualifies for.

3. Multidisciplinary Competency (at least medium level of immersion):

Students will experience and document multidisciplinary character through coursework outside their major and through documented collaboration with students and mentors from other disciplines. In their portfolio, the student will clarify their understanding of interdisciplinary team work, and discuss how they expect different disciplines to address their selected Grand Challenge topic. Next are some examples how students can satisfy different levels of immersion.

Medium:

This will require two or three 3-credit hour multidisciplinary courses connected to at least one of the Grand Challenges themes. These courses could be required CAP course in inquiry, integrative or capstone depending on the actual content. The Creative Analytics Mini-Series can be

counted as a multidisciplinary course as well. A completed Sustainability, Energy and Environment (SEE) minor satisfies the multidisciplinary competency at a medium level.

High:

In addition to coursework explained in the medium level, a high level of immersion would require a multidisciplinary co-op experience, or engagement with activities offered by the Office of Experiential Learning, Hanley Sustainability Institute, Fitz center or similar all of which must be included and explained in the portfolio.

4. Viable Business / Entrepreneurship:

Students will develop an understanding of business and entrepreneurship areas through participation in coursework and/or mentored exercises to generate viable business model(s) for successful implementation of Grand Challenge solutions. Here are some examples of how students can satisfy different levels of immersion.

Low:

This will require a 3-credit hour course related to business / entrepreneurship and connected to at least one of the Grand Challenges themes. This course could be one of the open electives many students at UD have to take.

Medium:

The first criteria to satisfy is for the student to take at least one course in the area of business and entrepreneurship and connected to at least one of the Grand Challenges themes. Additionally, the student will choose one more activity such as:

- taking 1-2 additional courses offered by the School of Business related to entrepreneurship or innovation
- taking part in the flyer pitch or similar events
- active participation (equivalent of 40 hours) in one of the many local area innovation hubs, immersion in an enterprise or startup activity or Leonardo Enterprises and KEEN events
- capstone experience could also count if a significant component of it is related to developing a viable business model.

High:

This will also require at least one 3-credit hour course related to business / entrepreneurship and connected to at least one of the Grand Challenges themes. For the high level the scholar must also participate in experiences that involve some aspect of translating an invention/innovation into a viable business model. This may range from risk-taking commercial ventures to implementing beneficial solutions for nonprofits. This could be demonstrated by being ranked highly in the flyer pitch or similar event, deep immersion in an enterprise or startup activity, or active participation in one of the many local area innovation hubs (equivalent of 80 hours), or application for invention disclosure, patent or other form of intellectual property. Alternatively, completing a minor (or major) offered by the School of Business will satisfy this requirement.

5. Social Consciousness:

Students will deepen their social consciousness and motivation to address 21st century issues which they will describe in detail in their portfolio. Here are some examples how students can satisfy different levels of immersion.

Low:

This will require a 3-credit hour course related to social consciousness and connected to at least one of the Grand Challenges themes. This course could be a required CAP course in social science, faith traditions or practical ethical action depending on the actual content.

Medium and high:

These levels of immersion require a 3-credit hour course related to social consciousness and outreach activities which may include service learning, volunteerism, mentoring K-12 students, or equivalent.

- Service learning options
- Volunteerism
- K-12 outreach in STEM
- Leadership role at community-centered organization
- ETHOS
- Fitz Center
- Hanley Sustainability Institute
- Office of Experiential Learning
- GEMnasium
- Living Learning Community
- Special Interest Housing

The duration and intensity of these activities will be the principal determinant for which level of immersion it qualifies for. Completing a major in human rights is a high level of immersion. Completing the SEE minor will count as a medium level and can be promoted to a high level through additional outreach activities such as the ones listed above.

Some resources that are already available at UD for the GCSP

Resource	Can be applied to which component number (at what immersion level) with what activity
Capstone experiences in many majors	1 (high) two semesters of project Potential for 3 and 4 at a (low or medium) level
Stander Symposium	1 (high) presentation or poster
University Honors Program	1 (high) honors thesis
SURE program in SoE Dean’s summer fellowship in College ISE CoRPS program	1 (high)
CAP (Common Academic Program)	2-5 (low) taking a course 2-5 (medium) taking a sequence of courses

GEMnasium	Provides opportunities for 2-5
IACT at Art Street	Provides opportunities for 2-5
Study Abroad programs in many units	2 (high) being abroad for at least one semester 2 (medium) being away for a few weeks
ETHOS	2 (high) one or more semesters, provides opportunities for 5
Co-op Program	Provides opportunities for 2-5 (especially 3 and 4)
Office of Experiential Learning	Provides opportunities for 2-5 (especially 3 and 5)
Hanley Sustainability Institute (HSI)	Provides opportunities for 1-5 (especially 3 and 5)
Fitz Center	Provides opportunities for 2-5 (especially 3 and 5)
Creative Analytics Mini-Series	3 (medium) if combined with other multidisciplinary experience
SEE Minor	3 (medium) and 5 (medium) if completed
Leonardo Enterprises (Incubator)	Provides opportunities for 4
KEEN	Provides opportunities for 2-5 (especially 4)
Flyer Pitch	4 (high) give pitch and be ranked highly or 4 (medium) give pitch
Various business minors	4 (high) if completed
Major in human rights	5 (high) if completed; (medium) if partially taken
Living Learning Community	5 (low or medium) depending on involvement and scope
Special Interest Housing	5 (low or medium) depending on involvement and scope

Admissions Essay

Applicants must complete a two-page essay by addressing all of the following prompts to showcase commitment to the Grand Challenges Scholars Program:

- Define how your Grand Challenge relates to the University of Dayton's mission for the Common Good and institutional learning outcomes.
- Illustrate what scholarly or commercial gaps exist in addressing your selected Grand Challenge.
- Explain which seemingly unrelated fields of study will be required to implement effective solutions for your selected Grand Challenge.
- Demonstrate how your selected Grand Challenge impacts various cultures, both marginalized and privileged.
- Describe what is needed to help the mainstream ensure that solutions for your selected Grand Challenge are consciousness of social and environmental impacts.

Formatting of the essay should follow these guidelines:

- 12 point, Times New Roman font
- Double-spaced
- Numbered pages
- File Name (Last Name GCSP Admissions Essay)
- Submitted as a Word or PDF document

Grammar, clarity, and organization will be considered when evaluating applications since your essay serves as an example of your ability to synthesize ideas in a professional manner.

Evaluation Rubric

This rubric will be used by those evaluating your application. Ensure that your admissions essay meets exemplary requirements before submitting.

Component	(1) Insufficient	(2) Sufficient	(3) Exemplary
Mission	No clear connection to mission and learning objectives	Evident connection to mission and learning objectives	Connects mission and learning outcomes to vocation
Entrepreneurship	No clear perception of needs for chosen Grand Challenge	Evident perception of needs for chosen Grand Challenge	Dynamic insight of needs for chosen Grand Challenge
Multidisciplinary	No clear connection of contributions from multiple disciplines	Evident connection of contributions from multiple disciplines	Innovative synthesis of contributions from multiple disciplines
Multicultural	No clear inclusion of Grand Challenge's impact on cultures	Evident inclusion of Grand Challenge's impact on cultures	Thorough analysis of impacts on cultures at multiple levels
Consciousness	No clear recognition of ethical tensions in Grand Challenge	Evident recognition of ethical tensions in Grand Challenge	Articulation of ethical dilemmas present for Grand Challenge

Frequently Asked Questions

Do I have to be in the School of Engineering to participate?

This is not just for engineers! This program is open to ALL majors.

Can I use previous experiences at UD as credit toward the requirements?

Absolutely, as long as they fit.

Does it cost any money to apply or participate in the program?

There is no direct cost, however, spending a semester abroad or similar activities which may be required for the completion of the program does cost money.

Do I receive any money for being enrolled in the program?

Unfortunately, you do not. However, upon successful completion of all requirements at graduation you will receive a certificate from the National Academy of Engineering making you a Grand Challenge Scholar and you will be added to their (prestigious) Alumni list...

Is there a penalty for being enrolled but not completing the requirements?

There is not. The steering committee will strive to admit candidates who are likely to be able to complete all requirements, thus this will be hopefully not a problem.

Do I have to have a certain GPA to apply?

There is no minimum GPA requirement. However, the committee needs to be convinced that the additional workload can be handled by the applicant.

What happens if I am unable to attend one of the GCSP Connectivity events?

You will be allowed to miss a few a year and there will be make-up opportunities.

Can I choose my GCSP Mentor?

Absolutely. In fact, this is the desired method.

What happens when I complete the GCSP requirements before graduation?

Congratulations! You can sit back and cruise to graduation :-)