

Grand Challenge Scholars Program
Proposal
for
College of Engineering
Villanova University



Randy Weinstein, PhD
Interim Dean



Andrea Welker, PhD, PE
GCSP Director
Associate Dean for Academic Affairs
610-519-4959, andrea.welker@villanova.edu

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Vision and Goals

Villanova University is a comprehensive Roman Catholic institution founded in 1842 by the friars of the Order of St. Augustine. The University welcomes students of all faiths and is located in a western suburb of Philadelphia. The University offers a wide variety of degree programs through six colleges: the College of Liberal Arts and Sciences, the School of Business, the College of Engineering, the Louise Fitzpatrick College of Nursing, the College of Professional Studies, and the Charles Widger School of Law. The College of Engineering offers five BS and nine MS programs through its four departments: Civil and Environmental, Chemical, Electrical and Computer, and Mechanical. The College also offers a PhD. The university's Carnegie Classification is a Doctoral University with moderate research activity (R-3).

The University's motto is Veritas, Unitas, Caritas (Truth, Unity, Love). These three principles guide all that we do at Villanova; the result is that we seek to educate a different type of engineer that understands the power of engineering to improve lives of people worldwide. The Grand Challenge Scholars Program (GCSP) will encourage our students to create a plan of study that broadens their perspective and enables them to work on solutions to problems that affect millions of people. We will leverage our strengths in sustainability, service learning, engineering entrepreneurship, study abroad, undergraduate research, and interdisciplinary learning to create a GCSP that is unique to Villanova. Our Scholars will become part of the larger community of students participating in this effort, which will further broaden their academic experience.

At least initially, our program will focus on these challenges, which build upon our research expertise:

- Make solar energy economical
- Provide access to clean water
- Engineer better medicines
- Secure cyberspace
- Restore urban infrastructure

In summary, the vision of Villanova's GCSP is to create a program that enables our rigorously and holistically educated students to use their in- and out-of-class experiences to develop a plan of study that results in deeper learning as well as a deeper understanding and appreciation of the grand challenges facing society. The goals of the program are to leverage our existing strengths and develop new opportunities for learning for our students, faculty, and staff.

Steering Committee

The steering committee will meet once each semester to approve plans of study and certify completed dossiers. The committee will be composed of the GCSP Director, the four faculty mentors, the Associate Dean for Academic Affairs, the Director of Villanova Engineering Service Learning (VESL), a representative from the Center of Research and Fellowships, and three outside members (Table 1).

Table 1. Steering Committee

Position	Name	Roles and Responsibilities
GCSP Director*	David Campbell, BCE '76, MCE '81	<ul style="list-style-type: none"> • With faculty mentors, admits students • Organizes steering committee meetings • As part of steering committee, reviews and approves plans of study • As part of steering committee, reviews and approves completed dossiers • Organizes annual GCSP symposium • Orders stoles, notifies NAE, and notifies college staff when students complete program
Associate Dean for Academic Affairs	Andrea Welker	<ul style="list-style-type: none"> • Meets periodically with GCSP director to ensure program is running smoothly • As part of steering committee, reviews and approves plans of study • As part of steering committee, reviews and approves completed dossiers
Director of VESL	Jordan Ermilio	<ul style="list-style-type: none"> • As part of steering committee, reviews and approves plans of study • As part of steering committee, reviews and approves completed dossiers
Representative from Center for Research and Fellowships	TBD	<ul style="list-style-type: none"> • As part of steering committee, reviews and approves plans of study • As part of steering committee, reviews and approves completed dossiers
Faculty mentors	Chemical Engineering: Scott Jackson Electrical and Computer Engineering: Pritipal Singh Civil and Environmental Engineering: Stephanie Walkup Mechanical Engineering: TBD	<ul style="list-style-type: none"> • Meets at least once per semester with advisees to help student develop, revise (as needed), and fulfill their plan of study • Certifies completion of components • As part of steering committee, reviews and approves plans of study • As part of steering committee, reviews and approves completed dossiers
Outside members*	TBD	<ul style="list-style-type: none"> • As part of steering committee, reviews and approves plans of study • As part of steering committee, reviews and approves completed dossiers

* Term is for three years, renewable one time

We are blessed with an active alumni network and strong industry contacts with non-alumni. The outside members will serve 3 year terms with the option to renew one time. We will stagger the terms for the first three years to ensure consistency. Nominations for the steering committee will be obtained from each department. We will seek to balance expertise, public/private sector, gender, years of experience, ethnicity, etc. to create a diverse committee.

The steering committee will meet during the 8th week of each semester. The first half of the meeting will be devoted to reviewing and approving plans of study. The second half of the meeting will be devoted to approving completed dossiers and discussing any problems, changes that need to be made, and ways to improve the program. The members of the steering committee will also be invited to any cumulating research or capstone design presentations by the GCSP scholars.

Recruiting

Recruiting for the GCSP program will begin before students enroll at Villanova. We will prepare materials for distribution at our Preview and Candidate’s Days. We will also discuss the program during freshmen orientation and in EGR 1200 Egr. Interdisciplinary Proj. I, our introduction to engineering course held in Fall of Freshmen year. We will ask the professors teaching EGR 1200 and the professors advising freshmen to identify students they believe would excel as a scholar and ask them to apply. It is important to note that all faculty will be informed of this program and can encourage students to avail themselves of this opportunity.

Application and Selection

Students will have two opportunities to apply to the program: December 1st and May 1st of Freshmen year (Table 2). The goal is to have approximately 20 students per class enrolled, which is approximately 8% of all students. This cohort size was selected because it will not overburden departments/faculty, while engaging a meaningful number of students. The accepted students will be distributed evenly amongst the departments. As part of the application process students will state why they are interested in pursuing the GCSP and which grand challenge forms the unifying theme for their plan. Applications will be judged on the student’s current grade point average and their passion for exploring their selected theme. Students should have a minimum cumulative GPA of 3.0 and may apply up to two times.

Table 2. Application

Student name:	
Student ID:	
Grand Challenge Theme:	
Why you would like to pursue this theme (200 words or less)?	
How might you fulfill the five GCSP components (200 words or less)?	

Faculty Mentors

Each of our four departments will have a faculty mentor for our GCSP. Assuming that the students are evenly distributed amongst the departments, each of the four departments will have about five students per year, or 20 over the course of four years. These mentors will meet with the GCSP students *at least* once every semester, during academic advising, to ensure that the students are on track to fulfill the requirements. The faculty mentors may choose to meet with their advisees individually or as a group.

We will develop a section for GCSP on our Intranet, Engineering Connects, to provide an easy, efficient, and robust form of communication about the program.

Funding and Support

Initially, funding for the GCSP initiatives will come from the College. However, as all of the components exist at Villanova already, there should not be a significant cost associated with implementation. The major costs associated with this proposal are hosting the steering committee meetings, travel to GCSP events, and recognizing students at graduation. Students in this program will be encouraged to take advantage of existing funding opportunities at Villanova such as support for students to attend conferences and to perform research over the summer. We will also work with our Development office to secure outside funding sources from donors and foundations.

The initial budget for the GCSP program will include funding for:

- Pamphlets for recruiting
- Stoles at graduation
- Food for steering committee meetings (twice per year)
- Food for annual scholar/steering committee gathering
- Travel funds for selected members of the steering committee to attend the GCSP annual meeting in Washington, DC and the Grand Challenge Summit, which is held every other year

It is anticipated that the budget will grow as the program grows.

Unique Aspects

Villanova will bring a uniquely Augustinian perspective to our GCSP. The five GCSP components already exist in various forms at Villanova; this program will enable our students to create a coherent and meaningful program out of these experiences. Specifically, we will leverage the strengths of these existing programs/opportunities:

- Undergraduate research: 40% of our undergraduate students are engaged in research either for pay or for credit indicating that this is easily available option for our students.
- Harris Summer Innovation Program (HSIP): this summer program is a partnership of Villanova University's College of Engineering and Harris Corporation. [HSIP](#) provides student teams (typically four groups of four students) the opportunity to develop innovative solutions to unmet societal or technical challenges in an interdisciplinary team.
 - Student teams manage all aspects of their projects—from problem statement and initial design concept through prototyping.
 - Student teams own any Intellectual Property they create during their HSIP residency.
 - Teams deliver final presentations to representatives of Harris Corporation at the company's corporate headquarters in Melbourne, Florida.
 - While in Florida, interested students have the opportunity to interview with Harris for a summer internship or fulltime position.
 - Students receive a stipend, room, board, and a budget for their project.
- VIA Integrated Academics: this is an interdisciplinary certificate program offered by the University that draws students from all majors. The goal of these courses is to show students

how diverse disciplines work together in real-world scenarios. Students who complete six credits within a [VIA](#) specialization will receive a certificate designation.

- Engineering Entrepreneurship minor ([summer](#) or [academic year](#)): this 16 credit minor is one of our most popular minors in the College. Recently we opened the minor to all majors at the university to improve the interdisciplinary nature of the projects and teams. The opening of the minor to all majors has already produced results with approximately half of the summer program applicants hailing from majors outside of the College.
- Sustainability Studies minor: this is a very popular [minor](#) with our engineering students. Students take six classes for 18 credits to fulfill science and technology, policy, and humanities stems. This minor is jointly administered by the College of Liberal Arts and Sciences and the College of Engineering and has students from Arts & Sciences, Engineering, and Business enrolled.
- Semester study abroad: 22% of our engineering students study abroad for at least a semester as opposed to the national average of 5%. Current locations include Italy, Ireland, and Australia and more locations are added frequently.
- Internship or research abroad: very few of our students obtain internships abroad. We are hoping to elevate the popularity of this option and are eager to work with our Office of Education Abroad on developing these opportunities.
- Selected minors in the College of Liberal Arts and Sciences:
 - Africana Studies
 - Arabic Language and Cultural Studies
 - Asian Studies
 - Chinese Language and Cultural Studies
 - French and Francophone Studies
 - Irish Studies
 - Italian
 - Japanese Language and Cultural Studies
 - Latin American Studies
 - Russian Language and Cultural Studies
 - Spanish
- Service learning: Villanovans have a strong devotion to service both locally and abroad.
 - Villanova Engineering Service Learning (VESL): [VESL](#) has been engaged on over 40 projects with 17 partners in 12 countries over the past decade. We send students on-location every fall, spring, winter, and summer break. Typically, about 50 students participate in projects each year.
 - STEM Outreach: We also recognize that there are needs closer to home. We have several STEM outreach efforts that enable our students to serve the local community such as [NovaCANE](#) (Community Action by New Engineers), [VESTED](#) (Villanova Engineering, Science, Technology, Enrichment, and Development), and [NovaEdge](#) (Diversity in Engineering weeklong summer camp). Currently, about 20 faculty participate in STEM outreach efforts locally.
 - Campus Ministry: Campus Ministry offers service opportunities both [locally](#) and [abroad](#).

- Villanova Center for Research and Fellowships: this [office](#) supports undergraduate research by providing funding and matching of students to faculty. Students in the GCSP will be able to leverage the opportunities provided by this center to fulfill the components of the GCSP.
- Villanova Honors Program: it is anticipated that there will be some students in our [Honors](#) program that also pursue the GCSP. We will work closely with Honors to ensure that the resources provided by the Honors program was utilized for the GCSP.

Five GCSP Components

The five GCSP components of research, interdisciplinary, entrepreneurship, global dimension, and service learning could be fulfilled by the scholars in numerous ways. We are fortunate to be at a University that already values these five components and has made commitments to these ideas prior to pursuing this proposal. The options for fulfilling these components is described in Table 3.

Table 3. Options to Fulfill the Five GCSP Components

GCSP Component	Requirement
Research	1 semester of undergraduate research by completion of CEE 4612, CHE 4831, CHE 4832, ECE 5991, ECE 5992, ME 5001, ME 5002 or 45 hours of paid research under the direction of a faculty member or 1 semester of an capstone design project approved by the steering committee by completion of CEE 4606, ECE 4970, ECE 4971, ME 5005, ME 5006
Interdisciplinary	Approved experience such as Harris Summer Innovation Program* or VIA Certificate* or Engineering Entrepreneurship Minor (summer or academic year)* or Sustainability Studies Minor
Entrepreneurship	Approved experience such as Harris Summer Innovation Program* or Engineering Entrepreneurship Minor (summer or academic year)* or VIA Certificate in Innovation, Creativity, and Entrepreneurship*
Global/Multicultural	Semester or summer study abroad or Summer abroad research or internship or Selected minors from the College of Liberal Arts and Sciences
Service Learning	25 hours of service such as: Villanova Engineering Service Learning (VESL) experience or STEM outreach activities

*a given experience can only be used once

Mentorship, Support, Tracking, and Assessment

Each component has several options to provide students with maximum flexibility to design their own, personally fulfilling program. When students enter the program they will complete a plan of study form (Table 4). This will allow the student and their mentor to determine how they are progressing through the program and if any changes need to be made. It will be incumbent upon the student to show the relationship between the option they selected to fulfill each component and their Grand Challenge theme. After this initial meeting, each scholar will meet with their faculty mentor *at least* once each semester during academic advising. It is anticipated that the plan of study will be a living document that will change over time; new opportunities will become available and the student will gain feedback and advice from their mentor and steering committee. Students must maintain a cumulative GPA of 3.0 to remain in the program.

The process of completing the program is shown as Figure 1. As students fulfill each component, they will upload a one page reflection describing how their selected activity fulfilled that component for their theme. When the student has completed the activities to fulfill all five components they will write and upload a two page reflection that relates what they learned about their theme by completing the program. The two-way arrows indicate the iterative nature of the plan of study; the process allows for changes to the plan initiated by the student and also based upon the recommendations of the faculty mentor and steering committee. Currently, we plan to utilize our Learning Management System (currently Blackboard) as a repository for the student's plan of study, approvals, and reflections; however, other portfolio methods will be considered.

Table 4. Plan of Study Form

Student name:				
Student ID:				
Grand Challenge Theme:				
GCSP Component	Selected Option of Fulfillment	Relationship to Selected Grand Challenge	Date Approved	Date Completed
Research				
Interdisciplinary				
Entrepreneurship				
Global/Multicultural				
Service Learning				

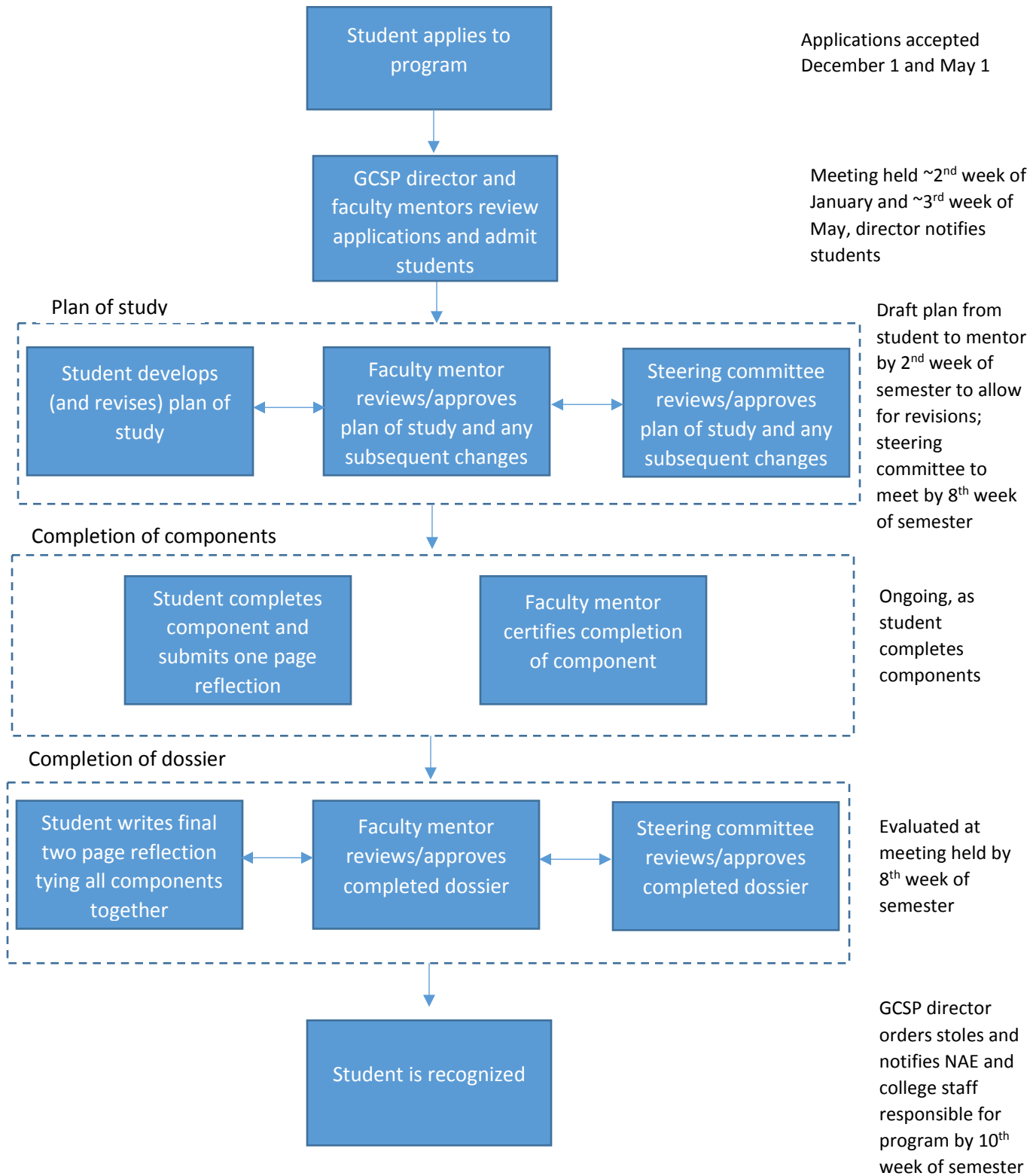


Figure 1. Progress through Program

Recognition

Students completing the program will have this accomplishment noted in the recognition ceremony program printed by the College. In addition, these students will receive a stole to wear with their academic regalia, will receive a certificate acknowledging their accomplishment, a letter from the President of the National Academy of Engineers, and inclusion on the scholars list on the GCSP website.