

Operational Document for the  
Grand Challenge Scholars Program at  
**The University of Maryland, Baltimore County**

---

May 2, 2016

Approved by

Julia Ross, Ph.D.  
Dean of Engineering and Information Technology

Prepared by

Marie desJardins, Ph.D.  
Associate Dean for Academic Affairs  
College of Engineering and Information Technology

University of Maryland, Baltimore County  
1000 Hilltop Circle  
Baltimore MD 21250  
(410) 455-3967  
mariedj@umbc.edu

## 1 Introduction

The University of Maryland, Baltimore County, is pleased to submit this proposal to establish a Grand Challenge Scholars Program (GCSP) at UMBC. The GCSP aligns strongly with the institutional goals outlined in the 2015 UMBC and COEIT strategic plans. The design of the GCSP is strongly influenced by UMBC's culture of innovation and diversity, as reflected in its placement as the #4 Most Innovative School in the 2015 U.S. News & World Report institutional rankings and the #2 Most Diverse University in the 2008 Princeton Review rankings.

Following the National Academy of Engineering's GCSP "Operational Document for Proposing a GCSP at Your School," this proposal presents UMBC's vision for its GCSP, how the five GCSP curricular components will be met, and the structure of the GCSP program, including Scholar selection and tracking.

## 2 GCSP Vision

UMBC's GCSP will exemplify UMBC's commitment to diversity, interdisciplinarity, applied learning, and collaboration. Our GCSP leverages strong existing programs in team-based engineering projects, global studies, interdisciplinary scholarship, entrepreneurship, cross-campus partnerships, and a community that places high value on diversity and academic achievement. A distinctive aspect of UMBC's GCSP is that students in non-engineering majors will be an integral part of the program: these *Interdisciplinary Grand Challenge Scholars* will complete the same requirements as the engineering Grand Challenge Scholars, sharing a learning community and providing a truly interdisciplinary learning experience for all students. Our program emphasizes explicit learning objectives in each of the five GCSP areas (research, interdisciplinarity, entrepreneurship, global learning, and service) as well as program-wide objectives, and incorporates student reflection on each of their learning experiences that ties back to these learning objectives.

The proposed GCSP will provide a strong learning community component. Each new cohort of Scholars will take a first-semester orientation seminar that engages them in a cohesive program of activities designed to orient them to the Grand Challenges, prepare them to engage in the five curricular areas, identify their selected Grand Challenge to focus their experiences, and help them to design an intentional, meaningful sequence of experiences to complete the program. As Scholars continue through the program, they will take additional seminars that provide supportive advising, sharing of experiences within the community of Scholars, and reflective consideration of the Grand Challenges experiences that they are planning and completing. The flexible design of our program structure enables each student to tailor their GCSP experience for their own interests and goals, while providing all

students with a broad set of learning experiences centered on the Grand Challenges and the five curricular elements.

UMBC's GCSP will take advantage of existing programs and activities that can satisfy the five required GCSP curricular elements, while creating an interdisciplinary community of scholars who will work together to understand and explore the Grand Challenges. Most students will formally enter the program in their junior year, but a Grand Challenge Affiliates program will provide opportunities for students to engage with the Grand Challenges and to acquire program experiences as early as their first semester. Alternative pathways for transfer students and students who wish to join the program later than the recommended timetable will ensure access for all students who wish to become involved.

Our Grand Challenge-related activities have already begun as we work towards formal recognition of the GCSP by NAE. The Fall 2015 freshman Honors Forum, which is required for all entering students who plan to complete an Honors Certificate, was centered around the Grand Challenges. Students worked in teams to complete a semester-long investigation of one of the Grand Challenges. At the final class meeting in December, teams presented their findings to a panel of judges (including GCSP Director Marie desJardins), and the highest-ranked team was honored at a luncheon with UMBC President Freeman Hrabowski. (Dr. Simon Stacey, Director of the Honors College, is a member of the GCSP Advisory Board.) The GCSP Advisory Board, which includes stakeholders from many different campus units, has held an initial meeting, endorsed the program, and contributed to the development and revision of this proposal. UMBC's Undergraduate Council approved the Grand Challenges Orientation Seminar (listed with a unique new course prefix, GCSP 301), which will be offered for the first time in Fall 2015. There is strong enthusiasm across campus for the GCSP, which is seen as aligning extremely well with UMBC's strengths and strategic directions.

### 3 Grand Challenge Curriculum

UMBC's Grand Challenge curriculum comprises two primary elements: the ***GCSP Seminars***, which build a community of scholars and provide a structured environment for the Scholars to work towards the program goals, and the ***GCSP Qualifying Experiences***, which permit each student to build a personalized curriculum that reflects their interests and background as they work to gain experience with their selected Grand Challenge(s).

**GCSP Seminars.** All students who have entered the Scholars program must complete three 1-credit seminars. The **GCSP Orientation Seminar**, taken in the student's first semester in the program, provides Scholars with an introduction and foundation for the Grand Challenge program, including the Grand Challenges themselves, ethical frameworks, completion of Responsible Conduct of Research

training, and initial creation of a GCSP e-portfolio. The initial e-portfolio will include a program entry reflection about the student's purpose in entering the GCSP, along with an identification of the student's personalized learning objectives (see Section 4.2). The seminar will also include diversity training and exploration of implicit bias issues, since knowledge in these areas is so critical for effective teamwork. Students will identify a particular Grand Challenge and focus area. The **GCSP Program Seminar**, modeled after UMBC's successful Interdisciplinary Degree Plan Writing Seminar, is taken in the second semester of the Scholar's participation in the program. The Program Seminar supports students in intentionally designing their pathway through the Scholars program by the selection and creation of their qualifying experiences, provides students with a forum to exchange their experiences and insights with each other, and offers scaffolding for them to build their e-portfolios and reflect on their experiences. Finally, the **GCSP Leadership Seminar**, taken in the Scholar's 3<sup>rd</sup> or 4<sup>th</sup> program semester, provides an opportunity for students completing the program to reflect on their experiences, share their learning and insights with new Scholars, and engage in outreach to the broader UMBC and local community.

**GCSP Qualifying Experiences.** Students must complete a validated experience each of the five program areas (Research, Interdisciplinarity, Entrepreneurship, Global Perspectives, and Service). Validated experiences receive a Gold, Silver, or Bronze level designation, based on the number of hours committed and the depth of the experience. (Roughly speaking, a Gold experience corresponds to 6 or more credit hours of activity; a Silver experience, to 3 credit hours; and a Bronze experience, to 1 credit hour.) To receive recognition as an NAE Grand Challenge Scholar at graduation, a student's program must include at least one Gold experience and no more than two Bronze experiences. (That is, the minimum expectation is that students will have one area in which they complete a Gold experience; two in which they complete Silver experiences; and two in which they complete Bronze experiences.) Students will create an e-portfolio that documents their qualifying experiences in each of the five program areas.

Specific existing activities and experiences will be pre-validated and have preassigned levels; students may also petition to have other experiences validated. The initial set of preapproved qualifying experiences in each area is presented in the subsections below. All experiences require students to submit a mini-proposal (containing a description of how their particular experience will relate to their selected Grand Challenge, satisfy the learning objectives for that program area, and meet the goals and requirements of the program), and to include a reflection about the experience in their e-portfolio. **Note:** Although some experiences may be applied to multiple categories at the student's choice, no single experience may be counted simultaneously towards more than one category.

**Assessment.** We have identified a set of core learning objectives that all GCSP students are expected to achieve, as well as a broader set of optional learning objectives, from which each student will choose a group of personalized learning

objectives for the overall program and in four of the five program areas. (See Section 4.2, Assessment and Tracking.) This approach to learning objective design and assessment permits us to ensure that all Scholars have a common basis of knowledge, but that individual students can focus on those aspects of the program that matter the most to them personally. We also believe that presenting the broader set of learning objectives to all students, as part of the learning seminars, will encourage students to be more reflective about their engagement with the Grand Challenges.

Subsection 3.1 presents overarching core learning objectives that span all five program areas; core learning objectives for each individual program area are given in the subsequent sections. Students are expected to explicitly tie their program experiences to these core objectives in the reflections they will prepare as part of their e-portfolios. Core learning objectives should be addressed in multiple program experiences, and will be emphasized in the three program seminars. In addition, as part of their reflection and personalization process, each student will identify personalized learning objectives from the broader set of learning objectives that is included in the appendix of the proposal.

### **3.1 Program-Wide Learning Objectives**

The GCSP program-wide learning objectives are centered around five of the affective functional competencies (AFCs) that have been proposed at UMBC for assessing applied learning experiences: Ethics and Integrity, Innovative Leadership, Teamwork, Resilience and Adaptability, and Self Awareness. Three additional AFCs are particularly related to specific program areas and are included in those subsections (Critical Agency (for the Research program area); Social Responsibility (Service); and Intercultural Development and Perspective (Global Perspectives)).

The full list of program-wide learning objectives is included in the appendix. The six core objectives are:

- **Integrity:** Identify and be able to elaborate on and justify core beliefs and values; act consistently in accordance with those beliefs and values across contexts; regard themselves as accountable for those actions.
- **Perspectivism:** Seek out and fairly consider ethical perspectives and concepts other than own, and ensures these perspectives and concepts appropriately inform their own actions and views.
- **Realistic vision:** Be imaginative in thinking about alternatives to the way things are, while being sensitive to the constraints of the real world.
- **Being a team member:** Identify strengths and weaknesses of all members of a partnership or collaboration; empower group members to use their strengths, and support weaker team members. Both assign and accept duties and roles intelligently and flexibly.
- **Persistence:** Confront difficulties resolutely, and persevere in trying to manage them. Reframe failures and mistakes as learning opportunities, and

does not allow them to become disabling or discouraging. Follow through on commitments.

- **Flexibility:** Adapt quickly and thoughtfully to unexpected changes and developments and accommodate them fluidly in plans and projects. Incorporate new information to progress toward intended outcomes.

### 3.2 Research

*“Each GC scholar must participate in a substantial team or independent project relating to a Grand Challenge theme or specific Grand Challenge problem.”*

UMBC is classified by the Carnegie Foundation as a Research University with High Research Activity. With over \$75 million per year in research expenditures, we are particularly proud of the extent to which undergraduates benefit from and contribute to our broad research portfolio. As the #6 university for undergraduate teaching (US News), we see involvement in research as a core part of the educational experience we provide our students. Mr. Don Engel, Assistant Vice President for Research, is a member of the GCSP Advisory Board.

Accordingly, UMBC invests heavily in fostering undergraduate research experiences. For our newer students who are not yet ready to propose their own research projects, we provide support to faculty in the form of Undergraduate Research Assistantship Support (URAS) grants, which can be used to support undergraduate research assistants in their first two years at UMBC. When students are ready to propose their own mentored research projects, they are encouraged to apply for grants in our Undergraduate Research Award (URA) program. We organize an annual Undergraduate Research and Creative Achievement Day (URCAD), at which several hundred students and student teams present their research as a poster or oral presentation.

All GCSP Scholars are expected to complete mentored research on topic related to their selected Grand Challenge, and to present their completed GC-related research at URCAD. Scholars completing Gold experiences are also expected to prepare and submit a research report to a publication venue such as an academic journal or conference, the *UMBC Review* (student research journal), or a regional student conference.

#### Learning Objectives

The learning objectives for the Research program element are based on a set of objectives that have been developed at UMBC to assess the learning of URA recipients, and on the Critical Agency AFC. The six core research learning objectives are:

- **Effective Communication:** Express ideas in an organized, clear, concise, and accurate manner.

- **Disciplinary Communication:** Write clearly and effectively in discipline-specific formats.
- **Creativity:** Effectively connect multiple ideas and approaches.
- **Practice and Process of Inquiry:** Demonstrate the ability to formulate questions and hypotheses within their discipline.
- **Nature of Disciplinary Knowledge:** Show understanding of the way practitioners think within the discipline and view the world around them.
- **Understanding Ethical Conduct:** Predict, recognize, and weigh the risks and benefits of the project for others.

### Gold

- Two-course capstone design sequence with a GC-related focus (e.g., ENCH 444/446; CMPE 450/451).
- Approved multiple-semester GC-related research experience (independent study, research internship, Undergraduate Research Award, departmental honors thesis, or non-credit research) equivalent to 10 weeks of full-time work.
- Immersive off-campus research project experience course during the summer session (under development).

### Silver

- Structured research course (e.g., ENCH 468) on an approved GC-related topic.
- Three-credit, one-course capstone design with a GC-related focus (e.g., ENME 444).
- Three-credit independent study research course with an approved GC-related focus.

### Bronze

- One-credit independent study research course with an approved GC-related focus.
- Significant GC-related research project within the context of a course with an appropriate focus.

### 3.3 Interdisciplinarity

*“Each GCSP should have an institutionally tailored mechanism that thematically draws together the engineering curricular components of each student’s course of study.”*

UMBC houses one of the oldest continuously operating Interdisciplinary Studies undergraduate degree programs in the country,<sup>1</sup> recognized in its most recent

---

<sup>1</sup> <http://inds.umbc.edu/about/our-history/>

(INDS) Academic Program Review as a model of its kind (“There is, arguably, no institution in the country better able to activate the potential of interdisciplinary and individualized undergraduate education than UMBC”). Further evidence for the quality of this resource comes in the form of an invitation to host the 39th Annual Conference of the International Association of Interdisciplinary Studies (IAIS) in 2017. The core curriculum of UMBC’s INDS program teaches students to recognize, articulate, and implement the scholarship of interdisciplinarity (SOI) using nationally recognized textbooks and peer-reviewed publications, complemented by co-curricular scaffolding and coaching to guide students through the metacognitive challenges of designing a coherent, individualized, interdisciplinary degree and capstone research project.

The GCSP will leverage this campus resource and experience to provide support for the GCSP Interdisciplinarity program element. The GCSP Orientation Seminar will incorporate key material from the foundational SOI course (INDS330, “Ways of Knowing”), and the GCSP Program Seminar will be modeled after the Interdisciplinary Degree Plan Writing Seminar. The INDS Program Director is a GCSP Advisory Board member, and has committed the full support of his unit and staff to support the GCSP in interdisciplinary content, pedagogy, and training. The INDS program will also showcase the work of the GSCP at the international IAIS conference in October 2017.

UMBC’s General Education requirements are designed to ensure a broad liberal arts foundation for students in all majors. Many of the courses that satisfy the Gen Ed requirements can also be used in their Interdisciplinarity program element, with appropriate advance planning. Information sessions for GCSP Affiliates will focus on how students can plan intentionally to select courses that are aligned with the GCSP requirements.

### **Learning Objectives**

The four Interdisciplinarity core learning objectives are based on the SOI curriculum at the core of UMBC’s INDS program. (Note that the Interdisciplinarity program area does not currently include optional learning objectives beyond the core. This may change as the program develops and additional potentially beneficial learning objectives are identified.)

- Recognize and define the different qualities of interdisciplinary and multidisciplinary work.
- Define, cite, and give examples of the core strategies for creating common ground between different disciplinary perspectives.
- Define, cite and give examples of the bridging strategies that facilitate the conscious integration of different disciplines.
- Identify and discuss the scholarship of interdisciplinarity in a given case study (e.g., a team project completed by the student) and the value it has added to the project.

## **Gold**

- Two-course capstone design sequence with a GC-related focus, working on an interdisciplinary team (e.g., ENCH 444/446; CMPE 450/451).
- Immersive off-campus project experience course during winter or summer session, working in an interdisciplinary team (under development).
- Completion of a minor in a related area with a clear alignment to the student's chosen GC focus area.
- Completion of a two-course sequence emphasizing the scholarship of interdisciplinarity (e.g., INDS 330/INDS 430) related to the student's GC focus area.
- Completion of a significant interdisciplinary internship (equivalent to 10 weeks of full-time work).

## **Silver**

- Participation in the freshman Honors Forum course with a Grand Challenges theme focus (currently being piloted; requires students to work in interdisciplinary teams to complete an investigation related to one of the Grand Challenges).
- Completion of a shorter interdisciplinary internship (equivalent to 6 weeks of full-time work).
- Completion of a course that emphasizes the scholarship of interdisciplinarity (e.g., INDS 330/INDS 430) related to the student's GC focus area.
- Completion of an introductory CS or Engineering course (for Interdisciplinary Grand Challenge Scholars).

## **Bronze**

- Completion of a course in an area outside the student's major with a clear alignment to the student's GC focus area.
- Completion of a 1-credit INDS seminar on challenges and strategies for interdisciplinary scholarship (under development).
- Attendance at 15 or more hours of research seminars and colloquia in multiple disciplines, with accompanying reflection on topics and relevance to the student's GC focus area.

### **3.4 Entrepreneurship**

*"Each GC scholar must participate in a curricular or meta-curricular component on the process of translating invention and innovation into market ventures."*

UMBC's Alex. Brown Center for Entrepreneurship (ABCE) is an example of UMBC's culture for creating strong cross-campus programs. Rather than housing the entrepreneurship program within a business school or economics department, UMBC's program is a freestanding center that includes affiliated faculty from across campus. The ABCE works closely with multiple departments and industry partners to provide opportunities for students and faculty to develop entrepreneurship skills

and apply them to pursue new ventures. The ABCE's Director, Ms. Vivian Armor, is on the GCSP Advisory Board.

Since being awarded a Kauffman grant in 2007 to infuse entrepreneurship across disciplines, UMBC has revised or developed over 70 courses with entrepreneurial skills and principles. A new Minor in Entrepreneurship and Innovation was approved in Fall 2011 and currently has over 120 students enrolled from 29 different majors. Entrepreneurship Faculty Fellows representing all three Colleges, along with the Director of the ABCE, serve as the governing body overseeing the Minor.

Additionally, the ABCE offers a wide range of initiatives for students including an Entrepreneurship Speaker Series, CEO Chats, targeted workshops, internships in early stage companies and/or community ventures addressing social issues, mentoring opportunities, and competitions where students can test out their ideas and win seed funding to launch their businesses.

### **Learning Objectives**

The Entrepreneurship learning objectives are drawn from our assessments of existing entrepreneurship coursework and activities at UMBC. In addition to these four core learning objectives, students will select a single personalized learning objective.

- Develop strategies for recognizing opportunities and identifying the tools for quality risk assessment.
- Exhibit skills for communicating ideas in a concise and logical way.
- Work effectively in teams focused on entrepreneurship-related projects.
- Apply entrepreneurial thinking to social issues and social problems.

### **Gold**

- Completion of the Entrepreneurship and Innovation Minor, including an ENTR 300 internship experience that is clearly connected to the student's GC focus area.
- Submission of an invention disclosure related to the student's GC focus area that builds on their GC-related research and project activity.
- Participation in multiple entrepreneurship competitions (e.g., the Idea Competition and the Cangialosi Business Innovation Competition) with a connection to the student's GC focus area.
- Completion of a significant entrepreneurship-related internship with a connection to the student's GC focus area (e.g., at a startup, in conjunction with UMBC's Entrepreneurs in Residence program at the BWTech incubators, or in an established company's innovative ventures division) (equivalent to 10 weeks of full-time work).

## Silver

- Completion of a shorter entrepreneurship-related internship in the student's GC focus area (equivalent to 6 weeks of full-time work).
- Completion of a project-based entrepreneurship course (e.g., ENTR 200 (Introduction to Entrepreneurship) or AMST/POLI/SOCY 205 (Civic Agency and Social Entrepreneurship)), with a course project connected to the student's GC focus area
- Completion of IS 498 (3D Printing for Entrepreneurship) with a client project in the student's GC focus area.
- Participation in an entrepreneurship competition such as UMBC ProveIt (an annual competition for student ideas about campus change), with a project connected to the student's GC focus area.

## Bronze

- Attendance at 15 or more hours of entrepreneurship presentations and colloquia, with accompanying reflection on topics and relevance to the student's GC focus area.
- Completion of a course with entrepreneurial content (approved as an elective for the ENTR minor) in the student's discipline or a discipline related to the student's GC focus area.

## 3.5 Global Perspectives

*"Students may participate in a curricular or meta-curricular component that instills elements necessary to develop innovations in a global economy, or address ethical issues of global concern. Domestic activities that stress global or cross-cultural implications may satisfy this component."*

Global learning is woven throughout UMBC, with multiple offices, programs, and activities specifically devoted to enhancing the global component of university teaching, research, and community service.

The *Office of International Education Services* is dedicated to advancing the international exchange of students, scholars, and faculty and to providing leadership in intercultural learning through study abroad. The *Study Abroad Office* enables students to spend a summer, winter, semester, or academic year at universities throughout the world.

The *Program in Global Studies* in the College of Arts, Humanities, and Social Sciences offers an interdisciplinary Bachelor of Arts degree, combining coursework in 11 departments and programs with rigorous foreign-language and writing requirements, study abroad, and experiential learning in the form of internships and other extracurricular activities.

The *Global Engineering Program* in the College of Engineering and Information Technology offers an innovative elective within the traditional engineering sequence. Delivered simultaneously to students at UMBC and international partner institutions, this multi-university course provides students with practical experience engineering in a global context. (UMBC's long-standing, continuous partner is the Universidade do Porto in Portugal.) Collaborating across time zones and cultures, students apply global engineering tools and techniques to complete multilateral design projects. These projects are case studies in global engineering inspired by guest lectures from the Millennium Challenge Corporation, Merck, Energy Star, and others.

UMBC's *Shriver Center* has established a longstanding relationship with the U.S. Peace Corps. UMBC participates in the Peace Corps Coverdell Fellows and Masters International programs for graduate students who have returned from Peace Corps service and those who are currently serving, respectively. With the Peace Corps Prep program, UMBC prepares undergraduate students for international development work and global citizenship through coursework and experiential learning.

### **Learning Objectives**

The learning objectives for the Global Perspectives element of the GCSP are based in UMBC's global learning assessments, and on the Intercultural Development and Perspective AFC. In addition to the four core Global Dimensions learning objectives, students will select two personalized learning objectives.

- **Working With Diverse Teams:** Exhibit proficiency working in or directing a team with ethnic or cultural diversity.
- **Global Citizenship:** Show self-awareness as "citizens of the world" as well as citizens of a particular country, and appreciation of the challenges facing mankind, such as sustainability, environmental protection, poverty, security, and public health.
- **Cultural Awareness:** Identify the broad attitudes, beliefs, values, assumptions, histories and communication styles of themselves and others and their relationship with others. Support and validate the cultural experiences of others, and incorporate multiple, potentially conflicting, perspectives into evaluative and analytical work.
- **Openness to Difference:** Welcome personal and cultural difference, seek to maximize the community of relevant stakeholders, and interact non-judgmentally with these stakeholders.

### **Gold**

- Completion of a Global Studies, MLLI, or other globally focused major or minor.
- Completion of a semester- or summer-long study abroad experience.
- Participation on an Engineers Without Borders travel team.

- Completion of a significant internship with a global focus (e.g., with a global NGO/nonprofit or in an international division of a global company) (equivalent to 10 weeks of full-time work).

### **Silver**

- Completion of two or more MLLI or other globally focused courses.
- Completion of a shorter intensive winter, spring, or summer session study abroad experience.
- Completion of a shorter internship with a global focus (equivalent to 6 weeks of full-time work).
- Completion of ENME 489 (Global Engineering).
- Completion of a Global Studies core course (GLBL 101 (Introduction to Global Studies) or GLOBL 301 (Approaches to Globalization)).
- Continuous, significant involvement (such as serving as an officer or committee chair) on an Engineers Without Borders project team, without travel.
- Participation in a Global Brigades project.
- Year-long participation in an Intercultural Living Exchange Living Learning Community.

### **Bronze**

- Active involvement with Engineers Without Borders for one year.
- Completion of an approved Global Studies gateway course or elective with a connection to the student's GC focus area.
- Completion of an advanced language or culture course with a relationship to the student's GC focus area.

## **3.6 Service Learning**

*“Students may participate in a curricular or meta-curricular component that deepens their social awareness and heightens their motivation to bring their technical expertise to bear on societal problems.”*

UMBC's Shriver Center, founded in 1993, is a national model for integrated service learning, with the mission of actively engaging students, faculty, and staff in the social issues of the metropolitan Baltimore region, both to improve the quality of life for residents of the region and to deepen the civic responsibility of all members of UMBC's community. Shriver Center programs include the Service-Learning practicum, the Shriver Living Learning Community for social change, the service-focused France-Merrick Scholarship Program, the Shriver Peacemaker Fellows, and the innovative BreakingGround program that highlights and promotes civic engagement throughout the UMBC community. Ms. Michele Wolff, Director of the Shriver Center, is a member of the GCSP Advisory Board.

## **Learning Objectives**

The learning objectives for the Service program area are centered around the Social Responsibility AFC (AFC5). In addition to the three core learning objectives, students will select one personalized learning objective.

- **Community Engagement:** Participate in community action, including campus community, neighborhood/city/state community, national community, global community, and others.
- **Civic Agency:** Regard themselves as connected to communities and social groups, and as able to proactively interact with them. Seek ways to make positive change.
- **Capacity for Reflection:** Consider role as social actor, impact on community, and effect of community involvement on self. Seek to strengthen and multiply skills for sustainable social solutions.

### **Gold**

- Participation on an Engineers Without Borders travel team.
- Significant multi-semester outreach or community service (e.g., through UMBC's Breaking Ground program, Shriver Center service learning program, alternative spring break, Habitat for Humanity, or Scouting program)
- Completion of a significant public service-related internship (equivalent to 10 weeks of full-time work).
- Participation in the Shriver Center Living Learning Community, including completion of PRAC 096 (Community Service & Learning Practicum).

### **Silver**

- Continuous, significant involvement (such as serving as an officer or committee chair) on an Engineers Without Borders project team, without travel.
- Significant semester-long outreach or community service (e.g., through UMBC's BreakingGround program, Shriver Center service learning program, alternative spring break, Habitat for Humanity, or Scouting program).
- Completion of a project-based service learning course (e.g., AMST/POLI/SOCY 205 (Civic Agency and Social Entrepreneurship)), with a course project connected to the student's GC focus area
- Completion of a shorter public service-related internship (equivalent to 6 weeks of full-time work).
- Participation in a Global Brigades project.

### **Bronze**

- Substantial involvement with individual outreach or community service experience.
- Active involvement with Engineers Without Borders for one year.

## **4 Program Structure**

Program direction and oversight will be provided by the GCSP Director. Dr. desJardins will serve in this role for the first year of the program; in later years, a faculty member will receive a stipend and teaching release to serve as GCSP Director. The GCSP Advisory Board (which has already been formulated and has met to provide input and feedback on drafts of this proposal) will provide advice and counsel on ongoing program improvements and activities. A GCSP Council will be constituted and empowered to make program modifications, review and validate student progress, and confer completed Scholar designations. GCSP Supporters are UMBC faculty and staff, as well as partners from outside UMBC (industry, government agencies, nonprofits, and/or the local community), who have expressed an interest in the program and are willing to support it in a variety of ways, ranging from publicity to recruiting to guest speaking. (There are about 20 individuals on the Supporters list at the current time.) Finally, GCSP Advisors are designated faculty members in participating majors who will meet with their program advisees each semester to advise and support them in their progression towards completion. (GCSP Advisors may be members of the Board or Council, or may be Supporters who are willing to serve in this more active role.)

The GCSP Director will also oversee the GCSP Affiliates program, which will be open to current UMBC students and prospective transfer students who are currently enrolled at community colleges and intend to transfer to UMBC. Affiliates will be invited to GCSP events throughout the year (guest lectures, student project presentations, and social events), and will also benefit from information sessions designed to help them understand and prepare for application to the GCSP.

The GCSP will initially be supported by the Dean's discretionary budget and by fundraising from local industry. We anticipate that through UMBC's budget process, we will ultimately obtain partial state support, with ongoing fundraising to augment this funding. Program costs will include the GCSP Director stipend, a part-time administrator salary, and nominal stipends for GCSP Council members and GCSP Advisors. Other program costs will include the August retreat, social events, guest speaker honoraria, commencement medals, and other community-building items (e.g., "logo wear"). Eventually, we hope to provide financial support for students wishing to complete qualifying experiences that incur a monetary cost – this support will depend on securing outside funding through grants and/or corporate donations, and perhaps an internal revenue stream (course fees or Student Government Association funding).

### **4.1 GCSP Scholar Selection**

Students who come to UMBC as first-time freshmen will be eligible to apply to the program after they have completed at least three semesters at UMBC. Transfer students may apply after they have completed at least one semester at UMBC. Engineering and computing majors must have completed the gateway requirements for their major.

Recruitment to the program will be accomplished through campuswide publicity, the Grand Challenge-themed freshman Honors Forum, visits by relevant research faculty to sophomore-level courses, and active recruitment by our faculty supporters in departments throughout the university. The broad campus-wide representation on the GC Advisory Board, and our partnerships with diversity-focused programs such as the Meyerhoff Program and the Center for Women in Technology, will ensure broad representation of students from different disciplines and demographic groups.

Students applying to the program are expected to:

- Have earned at least a 3.0 cumulative GPA. Students who have earned at least a 2.8 may apply, but will be accepted on probationary status. (To remain in the program, these students must earn semester GPAs of at least 3.0 and must bring their cumulative GPA to 3.0 by the end of their second semester in the program.)
- Have completed (or made significant progress towards) at least one qualifying experience in at least two of the five program areas (see curriculum description).
- Demonstrate an awareness of and commitment to social consciousness and global awareness.
- Exhibit a commitment to increasing diversity in Grand Challenge teams and solutions.

To apply, students must submit:

- An unofficial transcript.
- Documentation of the completed qualifying experiences.
- Responses to short essay questions about the Grand Challenges, social and global awareness, and diversity.
- Identification of two endorsers (UMBC faculty or staff, employers, or supervisors/contacts for outside activities), who will be asked to complete a short web form indicating their support of the student's application.
- Optionally, one letter of support (limit one page) from one of the provided endorsers.

The application deadline will be in early March (or early October, for students applying in the fall), and students will be notified of acceptance by early April (or early November for Fall applicants). Students will be selected based on a GPA cutoff, their demonstrated readiness to commit themselves to working towards solutions for the Grand Challenges, and validation of their completed qualifying experience.

The COEIT strategic plan, and the commitment letter signed by Dr. Ross, sets a goal of 20 students graduating from the program annually. However, based on early discussions with students, we anticipate high interest in this program. Also, some students who enter the program may not complete all of the requirements, so to

meet the goal of 20 graduates will require a larger entering cohort. We have therefore designed the program around a capacity of 50 students entering the program annually (30 from COEIT and 10 from each of the other academic colleges). If there is significantly higher demand, we may either cap the number of accepted students or expand the available program resources to accommodate larger cohorts.

Students who are not accepted to the program will receive feedback about the weaknesses of their application, and will be encouraged to apply again if these weaknesses could be remedied (e.g., through improved grades, validated experiences, more thoughtful essay responses).

Once accepted to the program, students must meet the requirements of a GCSP Scholar (maintaining a 3.0 cumulative GPA, enrolling in and passing the GCSP Seminar each semester, meeting with their GCSP advisor each semester, and making documented progress on the required qualifying experiences each semester).

Students who complete the program will receive a GCSP Scholar designation on their transcripts, a UMBC GCSP lapel pin, and a certificate of completion. Engineering majors who complete the program will also receive recognition on NAE's website and will wear the official NAE medal. Interdisciplinary Grand Challenge Scholars will receive recognition on UMBC's website and a UMBC-designed alternative commencement medal.

## **4.2 Assessment and Tracking**

Early engagement will be promoted through a GCSP Affiliates group that any student may join. The Affiliates program will include a discussion board/ mailing list, quarterly activities such as information sessions and presentations by current GCSP Scholars, and mailings with information about how to apply and upcoming deadlines. We will also organize a monthly colloquium with guest speakers, as well as other GC-related presentations (e.g., student presentations and panels) that all Scholars and Affiliates will be invited to attend. Other early-engagement activities that we hope to add over time include a first-year GC Living-Learning Community, a First Year Seminar focused around the GC, and a second-year GC journal club seminar.

We plan to hold a one- or two-day retreat each August to welcome the new Scholars, welcome back the returning Scholars, and create a sense of community by group activities and opportunities for Scholars to share and discuss their experiences and perspectives in the program.

A pre-assessment of the program's core learning objectives (overall and in each of the five program areas) will be given as an assignment in the first-semester GCSP Orientation Seminar, and an online post-assessment will be administered to all students applying for program completion. This assessment will primarily be used

for overall program assessment and continuous improvement, but a minimum passing score on the post-assessment will also be required for program completion.

Completion of requirements for students in the program will be demonstrated through their progressively developed e-portfolios. Learning objectives have been identified for each of the five program areas, as indicated in Section 3. As they develop their personalized Scholar program, students will work with their GCSP faculty advisor to identify a subset of the learning objectives that are especially relevant for their goals and interests. Students will be expected to demonstrate mastery of these objectives (at a level that corresponds to the experience level (Gold/Silver/Bronze)) in their e-portfolio documentation. On a rolling basis, students may submit a request for validation of completed program experiences, which will be reviewed by the GCSP Council. The primary mechanism for assessing learning objective mastery is through the documentation and reflection in the e-portfolio. The rubrics for the learning objectives are under development as part of ongoing campus efforts to develop baselines and assessment tools for the affective functional competencies from which many of the learning objectives are drawn. The rubrics for the reflections themselves are being constructed in coordination with other groups on campus that are increasingly using reflections to assess student learning, and will be refined and improved as our experience with the program unfolds. We will particularly draw on Karen Barnstable's "Four Dimensions of Reflective Learning,"<sup>2</sup> in developing the reflection rubrics.

All members of the GCSP Council and each of the students' GCSP Advisors will be trained and authorized to assess and validate the students' program experiences. The completion of the program requirements will be tracked through UMBC's existing online Degree Audit tool or a customized tool linked to the myUMBC authentication system. The GCSP Council will review the records of all students applying for program completion, verify that all program requirements have been met, and recommend students to the GCSP Director by a two-thirds vote of the Council members. The GCSP Director will be authorized to confer GC Scholar status on students, based on the recommendation of the GCSP Council. (We expect that there will be exceptional circumstances under which the Director will disagree with the recommendation of the Council; once the program is underway and the initial Council is formed, one of its first tasks will be to develop bylaws and policies for issues such as exceptions, appeals, and program changes.)

## 5 GCSP Advisory Board

---

<sup>2</sup> Karen Barnstable, "Four Dimensions of Reflective Learning," *Stable Transitions* blog posting, December 15, 2009. <https://kbarnstable.wordpress.com/2009/12/15/22-questions-for-reflection/>

**GSCP Director – Marie desJardins**, Associate Dean for Academic Affairs, College of Engineering and Information Technology, and Professor, Computer Science and Electrical Engineering

**Vivian Armor**, Director, Alex. Brown Center for Entrepreneurship

**Cathy Bielawski**, Director, Undergraduate Student Services, College of Engineering and Information Technology

**Lee Blaney**, Assistant Professor, Chemical, Biochemical, and Environmental Engineering, and Faculty Advisor, Engineers Without Borders

**Jian Chen**, Assistant Professor, Computer Science and Electrical Engineering

**Don Engel**, Assistant Vice President for Research

**Felipe Filomeno**, Assistant Professor, Political Science, and Member, Global Studies Coordinating Committee

**Stephen Freeland**, Director, Interdisciplinary Studies Program

**Amy Hurst**, Assistant Professor, Information Systems

**Allison Jones**, Associate Director of Corporate Relations, Office of Institutional Advancement

**Simon Stacey**, Director, Honors College

**Kathy Sutphin**, Assistant Dean, College of Natural and Mathematical Sciences

**John Stolle-McAllester**, Associate Dean, College of Arts, Humanities, and Social Sciences

**Michele Wolff**, Director, Shriver Center

**Marc Zupan**, Associate Professor, Mechanical Engineering, and Instructor, “Global Engineering: UMBC to Portugal”

## 6 Appendix: Learning Objectives

This appendix contains the full learning objectives for the overall program and each of the five program areas, including both the core learning objectives (underlined) and the optional learning objectives from which students select personalized learning objectives for each area.

### 6.1 Program-Wide Learning Objectives

Students will select two to four personalized program-wide learning objectives, in addition to the six core learning objectives (underlined).

- **Ethics And Integrity**
  - **Integrity:** Identify and be able to elaborate on and justify core beliefs and values; act consistently in accordance with those beliefs and values across contexts; regard themselves as accountable for those actions.
  - **Perspectivism:** Seek out and fairly consider ethical perspectives and concepts other than own, and ensures these perspectives and concepts appropriately inform their own actions and views.
- **Innovative Leadership**

- **Practicality:** Implement plan steps effectively, ensuring that mission and goals are compatible with practical considerations.
- **Realistic Vision:** Be imaginative in thinking about alternatives to the way things are, while being sensitive to the constraints of the real world.
- **Capacity to inspire and persuade:** Have the capacity to inspire and persuade people to support and engage in a unified activity.
- **Delegation and role identification:** Identify best roles for different people and delegate duties and tasks accordingly.
- **AFC3: Teamwork**
  - **Interest Recognition:** Recognize the interests, goals and concerns of partners and team members, including their own, which are fully disclosed.
  - **Being a team member:** Identifies strengths and weaknesses of all members of a partnership or collaboration; empower group members to use their strengths, and support weaker team members. Both assign and accept duties and roles intelligently and flexibly.
- **AFC6: Resilience And Adaptability**
  - **Persistence:** Confront difficulties resolutely, and persevere in trying to manage them. Reframe failures and mistakes as learning opportunities, and does not allow them to become disabling or discouraging. Follow through on commitments.
  - **Flexibility:** Adapt quickly and thoughtfully to unexpected changes and developments and accommodate them fluidly in plans and projects. Incorporate new information to progress toward intended outcomes.
  - **Honest Self-Assessment:** Recognize their own strengths and limitations and seriously consider both positive and negative feedback. Seek assistance willingly when necessary.
  - **Sensitivity to context:** Recognize and credit the validity of the perspectives of others, and modify plans, projects and own perspective based on this sensitivity.
- **AFC7: Self Awareness**
  - **Personal Accountability:** Internalize obligations to fulfill project goals, and holds themselves responsible to meet/exceed expectations.
  - **Emotional Intelligence:** Moderate emotions and reactions consciously and deliberately during a job. Know and manage their own triggers. Understand how others perceive self. Interpret the behavior of others accurately.
  - **Knowledge of Strengths and Weaknesses:** Know strengths and weaknesses and position self in projects to maximize contribution through strengths; seek help to improve skills that are weak.
  - **Self-Efficacy:** Self-direct, rely confidently on their own abilities and resources, but request help where necessary; constantly seek to improve and expand abilities.

## 6.2 Research

Students will select two to four personalized research learning objectives, in addition to the six core learning objectives (underlined).

- **Communication**
  - Use and understand professional and discipline-specific language.
  - Express ideas in an organized, clear, concise, and accurate manner.
  - Write clearly and effectively in discipline-specific formats.
- **Creativity**
  - Bring new insights to the problem at hand.
  - Show the ability to approach problems from different perspectives.
  - Combine information in new ways and/or demonstrate intellectual resourcefulness.
  - Effectively connect multiple ideas and approaches.
  - Demonstrate the ability to work independently and identify when input, guidance, and feedback are needed.
  - Accept constructive criticism and apply feedback effectively.
  - Display a high level of confidence in their ability to meet challenges.
  - Use time well to ensure work is accomplished and meets deadlines.
- **Practice and Process of Inquiry**
  - Demonstrate the ability to formulate questions and hypotheses within their discipline.
  - Demonstrate the ability to properly identify and/or generate reliable data.
  - Show understanding of how knowledge is generated, validated, and communicated.
- **Nature of Disciplinary Knowledge**
  - Show understanding of the way practitioners think within the discipline and view the world around them.
  - Show understanding of the criteria for determining what is valued as a contribution in the discipline.
  - Show understanding of important current individuals within the discipline.
- **Critical Thinking and Problem Solving**
  - Troubleshoot problems, search for ways to do things more effectively, and generate, evaluate, and select among alternatives.
  - Recognize discipline-specific problems and challenges established thinking when appropriate.
  - Recognize flaws, assumptions, and missing elements in arguments.
- **Understanding Ethical Conduct**
  - Show understanding and respect for intellectual property rights.
  - Predict, recognize, and weigh the risks and benefits of the project for others.

- Recognize the severity of creating, modifying, misrepresenting or misreporting data including omission or elimination of data/findings or authorship.
- **Intellectual Development**
  - Demonstrate growth from basic to more complex thinking in the discipline.
  - Recognize that problems are often more complicated than they first appear to be and that the most economical solution is usually preferred over convoluted explanations.
  - Approaches problems from a perspective that there can be more than one right explanation or model, or no correct answer.
  - Display accurate insight into the extent of their own knowledge and understanding and an appreciation for what isn't known.
- **Culture of Scholarship**
  - Be involved in the scholarly community of the discipline and/or professional societies.
  - Behaves with a high level of collegiality and ethical responsibility.
- **Content Knowledge Skills and Methodology**
  - Display detailed and accurate knowledge of key facts and concepts.
  - Display a thorough grasp of relevant research methods and is clear about how these methods apply to the research project being undertaken.
  - Demonstrates an advanced level of requisite skills.
- **AFC4: Critical Agency**
  - **Awareness:** Recognize the effect, on self and on what is being taught/learned, of environmental influences, cultural influences, and their and others' assumptions.
  - **Vision:** Envisage futures and possibilities that differ from the systemic arrangements of the present.
  - **Understanding of Role Within Systems:** Imagine themselves contributing to systemic change, including in the system in which learning is taking place.
  - **Inquiry:** Seek and develop problem-specific knowledge in order to identify and appropriately evaluate potential responses.
  - **Linking Theory to Practice:** Link theory and academic concepts to lived and practical experiences (of themselves and others). Inform academic and theoretical work with insights from practice and experience. Track constantly between theory and practice, testing them against each other.

### 6.3 Interdisciplinarity

There are four core learning objectives (underlined); students do not select personalized learning objectives in the Interdisciplinarity area.

- Recognize and define the different qualities of interdisciplinary and multidisciplinary work.
- Define, cite, and give examples of the core strategies for creating common ground between different disciplinary perspectives.
- Define, cite and give examples of the bridging strategies that facilitate the conscious integration of different disciplines.
- Identify and discuss the scholarship of interdisciplinarity in a given case study (e.g., a team project completed by the student) and the value it has added to the project.

#### 6.4 Entrepreneurship

In addition to the four core learning objectives (underlined), students will select one personalized Entrepreneurship learning objective.

- Apply creative and innovative thinking to solve problems.
- Understand successful organizations and effective leadership strategies.
- Develop strategies for recognizing opportunities and identifying the tools for quality risk assessment.
- Exhibit skills for communicating ideas in a concise and logical way.
- Work effectively in teams focused on entrepreneurship-related projects.
- Apply entrepreneurial thinking to social issues and social problems.
- Demonstrate an understanding of real-world entrepreneurship, including business plans, startups, and other projects.
- Network effectively with area entrepreneurs.

#### 6.5 Global Perspectives

In addition to the four core learning objectives (underlined), students will select two personalized Global Perspectives learning objectives.

- **Working With Diverse Teams: Exhibit proficiency working in or directing a team with ethnic or cultural diversity.**
- Demonstrate knowledge of the history, government, and economic systems of several target countries.
- Identify and address ethical issues arising from cultural or national differences.
- Be aware of cultural differences relating to product design, manufacture, and use.
- Exhibit consciousness of the connectedness of the world and the workings of the global economy.
- Understand the international aspects of topics such as supply chain management, intellectual property, liability and risk, and business practices.
- **Global Citizenship: Show self-awareness as “citizens of the world” as well as citizens of a particular country, and appreciation of the challenges facing mankind, such as sustainability, environmental protection, poverty, security, and public health.**

- **AFC8: Intercultural Development And Perspective**
  - **Cultural Awareness:** Identify the broad attitudes, beliefs, values, assumptions, histories and communication styles of themselves and others and their relationship with others. Support and validate the cultural experiences of others, and incorporate multiple, potentially conflicting, perspectives into evaluative and analytical work.
  - **Openness to Difference:** Welcome personal and cultural difference, seek to maximize the community of relevant stakeholders, and interact non-judgmentally with these stakeholders.
  - **Interpersonal Communication:** Communicate effectively with different stakeholders and promote productive intercultural dialogue.
  - **Situational Awareness:** Read, evaluate, and respond appropriately to specific contexts and their demands.

## 6.6 Service

In addition to the three core learning objectives (underlined), students will select one personalized Service learning objective.

- **Community Engagement:** Participate in community action, including campus community, neighborhood/city/state community, national community, global community, and others.
- **Civic Agency:** Regard themselves as connected to communities and social groups, and as able to proactively interact with them. Seek ways to make positive change.
- **Capacity for Social Analysis:** Identify and understand systems and structures at work in society.
- **Commitment:** Appreciate the importance of activism and involvement, and dedicate time and energy to them.
- **Capacity for Reflection:** Consider role as social actor, impact on community, and effect of community involvement on self. Seek to strengthen and multiply skills for sustainable social solutions.