

Inclusive Excellence Action Plan – CEMS

College of Engineering and Mathematical Sciences

Pillar 1: Academics

Central to the mission and strategic goals of the University of Vermont is excellence in the academic experience to help prepare members of our community to be globally responsible and engaged citizens, advance knowledge, and build critical thinking and problem-solving skills.

1. What are the benefits, impacts, and/or learning outcomes of your initiatives and practices? How do these initiatives and practices promote inclusive excellence in your college/division?

More diverse teams have been shown to produce better results/products. This is especially true in technology, but unfortunately the tech industry is still dominated by white males. This is not only bad for women and persons of color, who are missing out on high-paying and satisfying job opportunities, but is also bad for the tech industry and the economy as a whole¹. For example, although women's choices impact up to 85% of purchasing decisions, they make up only 15-25% of the technology workforce, even while over half a million jobs in computing went unfilled last year in the U.S. Actively working to recruit and retain women and students of color to our CEMS programs will thus have wide-ranging benefits to our students and our society.

CEMS has made substantial improvements in the number of females, students of color and international students. Since the fall 2013 the number of female students in CEMS has increased by 67%, the number of students of color has increased by 35% and the number of international students has increased by 34%.

Many of our initiatives are described as best-practices in more detail in response to question 2 below.

We have upgraded our facilities which are now providing fertile spaces for hands-on work and collaboration for our students, staff and faculty. This will help us create a more inclusive, supportive and welcoming environment for all students. As part of the summer 2017 remodel of Votey Hall a number of new spaces were created which have resulted in increased interactions between students and between students and faculty. For example, the new Design Studio (Votey 120) is occupied throughout the day with students working together on projects or classes. Also, Votey 308 is used by the Electrical and Biomedical Engineering faculty for office hours and ad hoc review sessions.

CEMS offers courses that promote diversity and inclusivity. In recent semesters, the College has increased the number of sections of these courses and has offered them more regularly, thus reaching more students. These courses include:

¹ <https://www.theatlantic.com/technology/archive/2013/10/we-need-more-women-in-tech-the-data-prove-it/280964/>

- 1) ENGR 010 (D1: Diversity in Math/Sci/Engr) addresses underrepresentation of women and people of color in STEM, ethical considerations, equal opportunity and Title IX;
- 2) ENGR 101(Engineering Communications) covers traditional and scientific writing forms and oral communication with the goal of improving students’ overall communication skills. This course is particularly effective and advantageous for our international student population and other English Language Learners;
- 3) STAT 095 “Statistics and Social Justice – expected to become STAT 052” that uses statistics to explore poverty, political representation, job discrimination, criminal justice, racial profiling, and more.

Educational literature, particularly engineering education literature, has shown that service-learning helps engage female and other underrepresented students. Civil and Environmental Engineering has implemented service-learning throughout its’ curricula.

CEMS has agreed to devote one college meeting for diversity training. The expectation is that training our faculty and staff to be more aware of the multi-cultural background of all members of CEMS (faculty, staff and students) will create a more welcoming environment for all.

2. What initiatives and practices for inclusive excellence does your division/college consider exemplary and could serve as a model or best practice at UVM?

Since the fall of 2013, the Computer Science Department has been one of only 15 U.S. schools who are members of the BRAID (Building Recruiting and Inclusion for Diversity) initiative, which is led by the Anita Borg Institute and Harvey Mudd College, with industry support. As part of this initiative we have instituted several best-practices for attracting and recruiting underrepresented groups (including women and under-represented minorities) to computing. Below, we describe two of these efforts, which could serve as models for other units on campus.

A) Changes to the introductory computer programming course, CS 021.

Sections of CS 021 are scheduled in pairs that are in the same timeslot. During the first week of classes all students are presented the same material in the same way, followed by a clicker quiz to assess their understanding of this material. Students are given a self-test, which includes their score on the clicker quiz but also questions about their learning style. On the latter, they rate themselves on a scale from 0 to 10 on things such as how quick they are to answer questions in class, whether they consider themselves a logical thinker, whether they like to be challenged in a course, whether the material presented so far felt overwhelming or straightforward, whether they consider themselves self-directed learners, and whether they are not intimidated by others in the classroom. Students are also asked about prior programming experience. Based on their score on this self-test, we recommend whether they should self-select into the “green” section or the “gold” section. The difference in the material presented to the two sections is minimal, but the way it is presented can be quite different. For example, in the green section, in-class programming exercises are broken up for the students into smaller steps. Furthermore, in the gold section things are often discussed in more depth, take more tangents, and throw in “gold group only” extras. The class is taught in a hybrid flipped format. Students are tasked with doing

certain preparations before class (e.g. watch short on-line video lectures on new concepts prepared by the instructor, read sections from the text, etc.). In the next class, they are given the opportunity to first ask questions about the pre-class materials and are then given a short clicker quiz on this material, following by in-class team program design and development exercises on paper. The other class day each week they bring their lap-tops and do laboratory exercises using pair programming. This emphasis on pair programming and teamwork helps the students get to know each other and form study groups. Each week they then are to complete programming assignments as homework individually. Both sections are given the same exams, during common exam period.

Most of the females select the green section. In the spring of 2017, 79% of the females selected the green section where as 48% of the males selected the green section. The result was that the green section was 30% female whereas the gold section was only 10% female. The findings so far are that the green section environment is overall less-intimidating for both males and females and both tend to speak out more than we believe they would if mixed with the more confident students in the gold section. In general, the green section tends to be a much more talkative crew. As a whole, they tend to do the pre-work and come with a lot of questions. This helps ALL in the green section, as once the questions start, others will quickly chime in. With the gold section, often there are no questions on the pre-work, in large part because many of them are over confident and do not even bother to do the pre-work. The majority of the gold section questions in spring 2017 actually came from the few more confident females that had selected this section. In both sections, the observation to date is that when asked questions, the males are more likely to take a risk and "guess" at an answer, whereas females will answer if they know the answer.

The overall course grade distribution of the two sections is very similar. We attribute this to the green section preparing more for class (this is all new to them), whereas the gold section students tend to be overconfident and don't put as much time into preparation for class or exams. Overall, we observe that the green/gold section split is serving all students well. In particular, the students arriving in intro programming with no prior experience seem to be particularly well served, but there is also some benefit to the more experienced and/or confident students who choose the gold section because class discussions can be more in-depth and take more than they otherwise could, thus helping to keep these students engaged. Since the majority of females self-select into the green section, they are clearly reaping the benefits.

Computer Science has seen an increase in the number of students opting to become majors/minors after taking their intro programming group after the format of this class was changed to green/gold section split, and these new majors/minors are typically from the green section.

B) Creation of new interdisciplinary majors that appeal to a more diverse audience

CEMS has created several new interdisciplinary majors in recent years, including the BS in Data Science, the MS in Complex Systems & Data Science, the (pending) PhD in Complex Systems & Data Science, the (pending) MS in Biomedical Engineering, and the BS in Biomedical Engineering. Approximately half of the students pursuing the BS in Biomedical Engineering are women. As enrollments in this degree grow it will help continue to grow the number and percentage of women in CEMS.

3. What goals does your college/division want to achieve within the next year? Within the next three years?

The college has had an aggressive goal of increasing the female representation of our student body. We have made substantial gains in this area over the last four years by increasing the percent of female students in CEMS from 18.6% to 23.6%, while at the same time increasing the percent of females in our incoming class from 17.5% to 25.8%. Over the next few year we hope to continue this trend with the goal of increasing the percent of females in our incoming class to 30% in three years.

CEMS implemented a practice that for faculty searches we invite three candidates to campus and the search committees are provided the opportunity to invite a fourth candidate if that individual is a diverse candidate. The goal is to increase the recruitment of minorities and underrepresented groups.

4. What strategies and resources (e.g., skills, expertise, financial) will your college/division use to meet your goals within a given component? What resources are needed?

CEMS has created a recruiting piece called Spotlight on Women in CEMS. This recruitment piece is meant to help us recruit more students and faculty. We have received very good feedback about this recruitment piece. We will continue to update it by highlighting new individuals.

CEMS has a number of resources to support our underrepresented groups. Matt Manz (student services) works with international students; Samantha Williams (graduate coordinator) provides support for graduate students; Lauren Petrie (career readiness coordinator) provides help to students in finding internships/jobs.

5. What metrics will your college/division use to gauge its progress with diversity and inclusive excellence goals?

- Percent of females in both the FTFY and the overall student population
- Percent of minority students in the college
- Minority faculty and staff in the college
- Number of female faculty members
- Number of underrepresented students in experiential learning

Pillar 2: Community

The University of Vermont aspires to be a community that affirms and demonstrates the value of the diverse identities and backgrounds of its members, promotes multicultural competence, and builds positive and productive connections throughout the community.

1. What are the benefits, impacts, and/or learning outcomes of your initiatives and practices? How do these initiatives and practices promote inclusive excellence in your college/division?

As we continue to improve the diversity training of our faculty and staff it will improve the diversity climate in the college. This should also translate into a more inclusive and welcoming environment for diversity in the classrooms.

2. What initiatives and practices for inclusive excellence does your division/college consider exemplary and could serve as a model or best practice at UVM?

The College supports a wide range of student clubs and organizations that provide opportunities for our students to apply knowledge they learn in the classroom in a real world, hands-on setting. We also offer professional societies that offer a wide range of activities and networking opportunities. Our student chapter of the Society of Women Engineers (SWE) interfaces with professional chapters of the organization, participates in outreach efforts at local schools and community centers designed to encourage girls to consider the STEM fields, and sends active members to national conferences to connect with women engineers from across the U.S. and beyond.

The college is also home to the Society of Women in Computer Science (SWICS), a local, homegrown organization that shares many of the same goals as SWE. SWICS also prioritizes creating safe spaces for women to come together as a community, work on projects, and discuss ways to engage more women in this historically male-dominated field.

In recent years, CEMS has developed a robust, inclusive recruitment campaign with the goal of further diversifying the CEMS community. It is crucial that prospective students from diverse backgrounds see that the college values their presence and contributions. Our recruitment campaign includes:

- Representation of women, students of color, and international students in College and department (e.g. Computer Science) recruitment materials; feature stories on women and students of color on our website, in recruitment brochures, and in SUMMIT, our semesterly college magazine.
- Representation of women, students of color and international students on student panels at Admitted Student Visit Days.
- Participation in Discovering UVM events that are geared toward students with diverse backgrounds who attend UVM's partnership high schools.
- Investment of financial and human resources (for two consecutive years) in sending a staff member to a large STEM college fair in New York City that attracts a diverse population of prospective students and parents from the New York metro area. Our Assistant Dean for Student Services has attended this event in collaboration with UVM's Assistant Director of Admissions for Diversity.

We have also invested heavily in CEMS Student Services in recent years, increasing student support across the board. Since Dean Garcia's arrival in 2013, we've created four new positions in CEMS Student Services:

- 1) An Academic Advisor for International & Special Programs who provides academic advising and support to international students and CEMS students studying abroad.
- 2) An Academic Advisor for Recruitment & Student Services who works closely with Admissions to recruit talented first year and transfer students from diverse backgrounds.
- 3) A Career Readiness Program Coordinator who facilitates internships, co-ops and professional opportunities for CEMS students; teaches professional development courses that prepare students to work in diverse workplaces; and works closely with employers to develop more opportunities for CEMS students.
- 4) A Graduate Programs Coordinator whose responsibilities include the development of a diverse graduate student applicant pool and holistic support of our current graduate students: a diverse group of students from many different nations and ethnic, racial and religious backgrounds.

As an example in the Department of Computer Science we have implemented a number of activities to increase the confidence and community among our CS majors, including a first year seminar for CS majors, an annual CS Fair (sponsored by several businesses and industry), an annual Agile Codefest (co-sponsored by State Street and IBM), strong career development support services including help with resume preparation, mock interviews, finding internships/jobs, and modification to the first year courses, which (in addition to splitting into green/gold sections) includes a lot of pair programming and teamwork that helps the students get to know each other and form study groups and such. In addition, with support from BRAID, we support activities for the Society of Women in CS and send students to Grace Hopper. Some of these initiatives are further elaborated below:

- i. The first year seminar for CS majors helps to build community and retention in the CS majors in a variety of ways, including (a) a 'speed-meeting' exercise in the second class, where every 5 minutes students have to find a new partner and explore their interests (through a set of leading questions); (b) students gain a breadth-first exposure to what CS is and what UVM CS has to offer through weekly guest lectures by CS faculty on the upper-division courses they teach; and (c) learn how to build a resume, start their 4-year plan, and find internships, (d) read several articles relating to the (lack of) diversity in computing and write a reflective essay on this topic.
- ii. Our annual CS Fair (<http://csfair.w3.uvm.edu/>) encourages CS students at all levels (from first year non-majors through graduate students) to present their computing projects to the community; this exciting event is a great resume-builder and includes free food, cash prizes, and fabulous networking opportunities with potential employers and creates a strong sense of pride and excitement in being part of our vibrant CS community.
- iii. Our Annual spring Agile Codefest (also a great resume builder) brings industry software engineers to campus to work side by side with student teams in learning and applying new software techniques and tools to creating apps that improve campus life; this popular

1.5 day event includes lots of free food and cash prizes and complements their formal curricula with industrial scale software engineering experience.

- iv. Using BRAID funds, we sent 18 students to the Tapia Celebration of Diversity of Computing Conference in S'15, and 18, 24, and 22 students to the Grace Hopper Celebration of Women in Computing Conference in F'15, F'16, and F'17, respectively. These conference experiences are tremendously empowering for our students, who come back with a renewed sense of commitment to staying in the field of computing; it also helps to strengthen bonds between the students who travel together on these trips.

In Mathematics we host the Sonya Kovalevsky Day—We have hosted two SK days—it is now an annual tradition. Dr. Kovalevsky was the first major Russian female mathematician and a pioneer for women in mathematics around the world.

Financially supporting two female undergraduate mathematics students to attend the 2018 Nebraska Conference for Undergraduate Women in Mathematics

Faculty Recruitment:

CEMS engages in numerous recruiting practices to increase diversity of our faculty. We believe that a more diverse faculty will foster a more inclusive learning environment for all members of our community, especially students. The following practices are critical to our recruitment efforts:

1. Created a new Associate Dean for Faculty Affairs, with an explicit charge to enhance diversity recruiting in the College.
2. Affirmative Action/Equal Opportunity training required for all Search Committees, to improve understanding of diversity outreach.
3. College-level incentives to perform diversity outreach in advertising.
4. College-level incentives to prioritize diverse faculty for on-campus interviews- in particular, an extra on-campus interview will be funded for a diverse candidate.
5. Expectation of a Diversity Statement in applications, and a guarantee (confirmed by the Dean's Office) that the Diversity Statement and expressed commitment to diversity are considered during candidate interviews and evaluations.
6. Outreach efforts focused on diverse communities. This includes, but is not limited to, the Richard Tapia Conference, the Grace Hopper Conference, and the McKnight Fellows Conference

These recruitment efforts have resulted in hiring two female TT math faculty in the last three years—these are the first female TT math faculty hired in many years.

3. What goals does your college/division want to achieve within the next year? Within the next three years?

CEMS will continue the many initiatives that have been highlighted above. In addition, CEMS Student Services hopes to work collaboratively with the Mosaic Center for Students of Color and their counterparts at other local institutions (such as Champlain College, St. Michael's College,

and Vermont Technical College's Williston Campus) to create a framework for supporting STEM Students of Color in the area. Despite recent increases in diversity in the CEMS student body, our college still lacks the critical mass to sustain active chapters of national organizations – such as the American Indian Science and Engineering Society, the National Society of Blacks in Computing, or the Society of Hispanic Professional Engineers – that exist at larger institutions. Given the realities of our size and the persistent underrepresentation of people of color in STEM, collaboration with other institutions seems like a powerful way to create that critical mass. We hope that together we can build a vibrant, multi-institution, student-run organization to support STEM students of color in greater Burlington. CEMS Student Services is currently seeking a HESA practicum student for the spring 2018 semester to help launch this initiative.

The Assistant Dean for Student Services has reached out to the National Action Council for Minorities in Engineering (NACME) to determine if/how UVM and CEMS might get involved in the organization. We are currently awaiting a response.

Through a combination of College growth and faculty turnover, we expect to further increase and diversify our faculty. Our new recruitment policies that further encourage bringing diverse candidates to campus set the stage for helping us achieve this goal.

4. What strategies and resources (e.g., skills, expertise, financial) will your college/division use to meet your goals within a given component? What resources are needed?

Dedicated funds to support advertising in appropriate venues to attract diverse faculty candidates.

Once CEMS Student Services effort to create a multi-institution support organization for students of color in STEM comes to fruition, that organization will require resources for initiatives, events, and potentially for student travel to conferences. Membership in NACME and participation in some of their scholarship initiatives may require the College and/or University to make a financial commitment.

CEMS is an annual sponsor of the Grace Hopper Celebration of Women in Computing Conference, where we actively recruit diverse graduate students and faculty who are underrepresented in CEMS.

In summer '17 we used professional development funds to send 5 of our faculty (who enthusiastically volunteered to go) to the POGIL (Process Oriented Guided Inquiry Learning) workshop in Rhode Island this summer. Our aim is to use discovery-based team learning into more of our classes (see <https://pogil.org/about>).

5. What metrics will your college/division use to gauge its progress with diversity and inclusive excellence goals?

CEMS Student Services will track interest and participation of CEMS students of color (and potentially other UVM students of color in STEM fields) in the multi-institution student

organization they hope to help create. This will help them determine if and how to move forward with the organization.

Other appropriate statistical data measures.

Pillar 3: Environment

The University of Vermont strives to create physical, virtual, and educational living, learning and work environments that are inclusive and accessible to all in our community.

1. What are the benefits, impacts, and/or learning outcomes of your initiatives and practices? How do these initiatives and practices promote inclusive excellence in your college/division?

Increased collegiality amid diversity of viewpoints.

Returning Engineering to Departments has resulted in increased engagement by faculty and new initiatives. For example, the BS Electrical Engineering degree program is being revised to increase student choice in coursework. This may result in more EE students pursuing non-technical minors to complement their engineering degree.

2. What initiatives and practices for inclusive excellence does your division/college consider exemplary and could serve as a model or best practice at UVM?

We have actively worked to change the culture of our CS Crew student group from one that was perceived by some misogynistic and unwelcoming to students of diverse backgrounds. The CS Crew is now widely seen as an organization that embraces inclusion and diversity. In fact, the 2016-17 the President of CS Crew was a woman of color.

We pride ourselves in taking any concerns about bias and discrimination that are brought to our attention very seriously. When our CEMS Student Services team hears any such concerns from students about faculty and/or other students, they are trained to deal with those issues immediately and proactively. They elevate issues to academic leadership, work closely with the Dean of Students Office and consult the Office of Legal Counsel as appropriate. For example, when a CEMS exhibited disrespectful and potentially harassing behavior toward female faculty members both in our college and in other academic units last year, we quickly intervened using all resources at our disposal, including a meeting between the student and the Dean of Students and the Assistant Dean for Student Services, supporting the issuance of a no-trespass orders, and consulting appropriate parties at both the College and University levels.

We incorporate many team projects into our classes.

We strive to create a strong sense of community amongst our faculty and students, as described previously.

3. What goals does your college/division want to achieve within the next year? Within

the next three years?

With the opening of the new STEM building our faculty, staff, and students will have a more focused home base.

4. What strategies and resources (e.g., skills, expertise, financial) will your college/division use to meet your goals within a given component? What resources are needed?

The new STEM complex will provide the necessary base for a much improved faculty/staff/student environment. Once that is in place, we will re-evaluate its' impact and develop new initiatives to continue to enhance the diversity climate in the college.

5. What metrics will your college/division use to gauge its progress with diversity and inclusive excellence goals?

Appropriate statistical data measures.

Pillar 4: Operations

Business operations and organizational processes (e.g., policy development, fiscal and capital planning, human resource functions, and organizational practices and procedures) are critical to the daily functioning and long-term health of the University of Vermont.

1. What are the benefits, impacts, and/or learning outcomes of your initiatives and practices? How do these initiatives and practices promote inclusive excellence in your college/division?

An inclusive work environment.

2. What initiatives and practices for inclusive excellence does your division/college consider exemplary and could serve as a model or best practice at UVM?

With support from the Global Gateways Program, CEMS created a new academic advising position in CEMS Student Services to address the unique needs of our international student population. Matt Manz, our Academic Advisor for International & Special Programs, works closely with our international students and strongly advocates for resources to support them. Matt also works with all CEMS students who intend to study abroad to ensure they pursue experiences that both keep them on track academically and build intercultural competencies.

3. What goals does your college/division want to achieve within the next year? Within the next three years?

A more integrated office environment.

Once Innovation is open every department will have a home office area and for the first time our college faculty in each of our departments will be co-located. We expect this to have a huge positive impact on the morale and climate in the college.

Our Academic Advisor for International & Special Programs is seeing an increase in CEMS students interested in studying abroad. He has begun to work with the Office of International Education to offer group information sessions to educate students on their options and responsibilities. In the coming year, he hopes to work more closely with OIE to identify programs through which more students can access study abroad without significant financial burden, and without getting out of sequence in their highly structured curricula.

4. What strategies and resources (e.g., skills, expertise, financial) will your college/division use to meet your goals within a given component? What resources are needed?

These strategies and resource needs will evolve as we move into the Innovation building. As our Academic Advisor for International & Special Programs continues to work with increased numbers of international students and domestic students studying abroad, we may need to decrease his first year advising load. This may have resource implications.

5. What metrics will your college/division use to gauge its progress with diversity and inclusive excellence goals?

Appropriate statistical data measures, such as international student recruitment and retention figures, and the percentage of CEMS students participating in study abroad opportunities.