Priority Education Directions | Cornell Engineering Undergraduate Education
August 2021

The Big Idea

In an era of rapidly evolving technology and complex global challenges, engineering has become a highly collaborative endeavor that plays a dynamic, central role in developing and implementing solutions to critical problems throughout the world. In addition to technical knowledge, future engineering leaders must possess a broad awareness and mastery of interpersonal and professional skills.

By providing a supportive learning community in which any student can receive excellent instruction in the technical and non-technical skills of engineering, as well as robust opportunities to practice those skills inside and outside the classroom, Cornell University's College of Engineering (COE) aims to produce graduates prepared to serve as innovative and ethical leaders in their chosen fields.

To this end, a COE committee on undergraduate education reviewed available data and engaged a wide range of constituents —including faculty, staff, and students — in a rigorous process to identify steps COE could take to make meaningful progress toward a goal of sustained excellence in undergraduate engineering education. From this intense work, four **Priority Education Directions** (PEDs) emerged.

Strategic Initiatives

For each **PED**, the committee recommended multiple *actions*, including the following:

1) **Promote, support, and expect excellence in teaching and advising:** *Recruit and hire tenure-track faculty with scholarship in engineering education in order to build a culture of teaching that uses deliberate, research-based methods to optimize learning outcomes.*
2) **Build an inclusive community to promote learning and well-being:** *To attract and graduate a diverse undergraduate class, expand recruitment partnerships, affordability, and dedicated support to student success.*
3) **Infuse professional education and experiential learning throughout the curricular and co-curricular experiences to develop technical and professional skills:** *Expand training through the Engineering Leadership Program to all COE undergraduates and include demonstrated competency in relevant skills and behaviors as a condition for graduation.*
4) **Reinforce diversity, equity, and inclusion (DEI) as foundational elements of COE:** *Set expectation that all faculty will participate in annual professional development in DEI and/or one of the following areas: teaching, mentoring, or student health and well-being.*

In addition to the PEDs and related actions, the committee recommended creating an **Office of Assessment** in COE to inform resource allocation and measure effectiveness of programs.

Outcomes

The end result of implementing the recommendations of the committee will be the international recognition of Cornell Engineering as an exemplar in graduating students with demonstrated excellence in the full range of skills — both technical and professional — necessary to become the leaders that will forge a better future. COE graduates will have a competitive advantage as a result of their experience in a learning community committed to inclusion, where their well-being was valued and they had opportunities to practice fostering similar support in successful teams and productive collaborations.

COE Undergraduate Education Strategic Planning Committee Report

Summary

In an effort to identify specific actions that would set the College of Engineering (COE) on a successful path to realizing a vision of sustained excellence in undergraduate engineering education, the Undergraduate Education Strategic Planning Committee first identified the following six relevant cross-cutting topics: diversity, equity, and inclusion; student well-being; teaching and learning communities; experiential learning; professional education; and teaching infrastructure. The committee then invited a wide range of constituents, including students, to a series of conversations on each topic and gathered feedback on collective vision and recommendations for actions and assessment. The committee also reviewed relevant available data. From this intense work, detailed recommendations resulted for each of the six areas, as did departmental plans that are even more specific in addressing strategies for curriculum enhancements. A cross-cutting recommendation is that all faculty will be expected to participate in annual professional development in at least one of the following areas: teaching; mentoring; Diversity, Equity, and Inclusion (DEI); or student health and well-being.

Four themes — or Priority Education Directions (PEDs) — also emerged:
1. Promote, support, and expect excellence in teaching and advising.
2. Build an inclusive community to promote learning and well-being.
3. Infuse professional education and experiential learning through the curricular and co-curricular experiences as a way to develop technical and professional skills.
4. Reinforce DEI as foundational elements of the College.

College resources are needed to support assessment, and it is strongly recommended that an Office of Assessment be created to support these efforts

PED OVERVIEW

1) *Promote, support, and expect excellence in teaching and advising*

Effective teaching and advising is fundamental to undergraduate education, so it is no surprise that this theme was prominent in every strategic planning discussion and subsequent recommendations. The need for faculty training was repeatedly raised as necessary action, as was strengthening faculty and staff advising through ongoing training and additional resource allocation. Other cross-cutting recommendations include hiring teaching support specialists in the departments and schools, improving college teaching infrastructure and making better use of room scheduling.

In addition to the committee's findings, two recommendations stem from discussions with the dean and with directors and chairs of schools and departments. First, in response to the changes in education stemming from the COVID-19 crisis and the desire to provide additional flexibility to students, the committee recommends a pilot program for one or more online undergraduate courses be developed.

A likely approach would be to link such a course with distance learning M.Eng. programs. Second, it is recommended that interested schools and departments hire tenure-track faculty with scholarship in engineering education, which would represent a substantively new direction for COE.

2) Build an Inclusive Community

The need for ongoing community building within COE was identified in multiple strategic planning discussions, resulting in recommendations that include convening a task force on the topic to explore what support of social connectedness might look like in order to identify resource needs and suggest more specific actions. Other proposals include "providing multiple opportunities...to engage in classroom-based and extracurricular learning communities," and "identify[ing] gaps or places to improve the student experience to create more positive inclusive experiences." The committee recommends that an implementation committee be created and charged with identifying opportunities for creating a more connected and inclusive COE student community. In addition to this action, particular attention should be paid to the opportunities for inclusion and community building inherent in the implementation of recommendations related to improving teaching infrastructure, expanding experiential learning opportunities, and enhancing professional education.

3) Professional Education and Experiential Learning

The committee envisions COE as a global leader in educating students in both the technical and non-technical skills of engineering, allowing students to practice both in context through experiential learning opportunities inside and outside the classroom. Professional education and experiential learning will be well known, signature elements of a COE education. In order to achieve this vision, COE will need to implement a non-technical engineering education curriculum following the blueprint outlined by the committee, including the recommended actions related to experiential learning. The existing Engineering Leadership Program is particularly poised to serve as a model to scale to the college as a whole, which could draw Engineering Communications, Ethics, and Entrepreneurship Programs into this effort.

4) Diversity, Equity, and Inclusion

DEI cuts across all of the topic area discussions and the vision encompasses faculty and staff, not just students. However, in focusing specifically on undergraduate education, the committee recommends continued attention to recruiting a diverse undergraduate class; continued attention to equity goals of access to resources, support, and opportunities for all engineering undergraduates; and increased attention to inclusion goals, particularly in the classroom, student organizations, and experiential learning. As indicated in the other PEDs, of particular note is faculty and staff training as a mechanism to improve teaching and advising, equity in access to professional education and experiential learning, and community building as a means to inclusion and improved well-being.

CROSS-CUTTING TOPICS AND RECOMMENDATIONS

EXPERIENTIAL LEARNING

- *How can Cornell Engineering provide more — and more effective — hands-on learning opportunities for undergraduates?*

COE aims to provide all undergraduate students with hands-on, experiential learning opportunities that allow them to develop both technical and non-technical skills. This educational strategy gives students a well-rounded, real-world experience that integrates practical and theoretical knowledge, while also encouraging them to explore and apply their skills in new environments.

There is currently a high demand from students to support this kind of programming, and it supports a core part of Cornell's mission to educate the next generation of global citizens. A central goal is to increase the number and quality of course-based experiential learning opportunities in COE. By also improving access to undergraduate research, entrepreneurial activities, project teams, internships and more, the college will ensure that all students have the opportunity to supplement their course-based work with the skills they need to succeed.

Ultimately, experiential learning will be known as a signature element of the COE education — easily accessible to all students, providing meaningful learning experiences and propelling graduates toward professional success.

Recommendations
1. **Increase on-campus experiential learning opportunities.**

Hands-on learning helps students learn how to work effectively in teams, apply classroom knowledge in real-world settings and navigate unforeseen challenges.

The COE already has several strong experiential learning programs in place, and by investing in these existing programs, the college will increase students' access to, participation in and quality of these opportunities. These include:

Cornell Engineering Project Teams
- This program provides students with unique learning opportunities that allow them to work across disciplines. Using teamwork and innovation, the teams solve complex, real-world problems and gain hands-on experience. These situations leverage curricular content and integrate learning goals into dynamic settings outside the classroom.
- Given that student demand currently exceeds the program's capacity, there will be a rapid return on investment by increasing the scope of the program. By adding three staff, expanding and renovating available spaces, and raising additional project funds, the COE will be able to offer this experience to an additional 200 students.

Maker Spaces
- Engineering students and organizations are fueled by curiosity and innovation, and they need access to more facilities that allow them to design and test new ideas.
- The college is encouraged to develop a new maker space that will complement existing facilities, such as the Emerson Manufacturing Lab and the Rapid Prototyping Lab.
- Maker spaces have the additional benefit of serving as campus-based social hubs that promote organic opportunities to build community.

Entrepreneurship on and beyond campus
- Efforts should be made to improve how programs are marketed to students and work to strategically plan innovation competitions such that they align with other curricular and extracurricular goals and responsibilities.
- COE should secure long-term support for flagship entrepreneurial programs such as the Kessler Fellows Program and business minors available through partnership with the Charles H. Dyson School of Applied Economics and Management.

Undergraduate research
- To raise the participation of undergraduate research, the college should develop a program that helps students find opportunities with faculty and communicates the expectations and learning outcomes of their research. This program will also outline standards and steps for conducting independent credit-bearing research.
- Another key step is to encourage faculty to increase the availability of undergraduate research positions in their lab groups. The college should invest in startup funds that support this effort, and it can also work with the Engineering Learning Initiatives to increase funding via the Undergraduate Research Grants Program.

2. **Provide better support for course-based and off-campus experiential learning**

To promote the benefits of experiential learning, the college aims to expand students' access to opportunities that foster real-world engagement through the collaborative process of discovery and creation. Many courses already include components of hands-on education, and a review of these courses can offer insights on where existing programs can be expanded and where new ones could better support student learning within departments and majors.

Course-based experiential learning
- The goal of successful course-based experiential learning is to teach students how to work effectively in teams and to navigate unexpected challenges. To further support these efforts across the college, the COE will leverage the forthcoming Collaborative Classroom Resources portal to help develop, improve and expand courses that have significant experiential learning components.
- Investment should be geared toward supporting faculty course improvement proposals and expanding teaching assistants' ability to help implement new ideas and strategies.

Internships/Co-ops

- o COE should seek to provide a greater diversity of internship and co-op opportunities, and it will also investigate possibilities for partnering with global companies so that students can gain experience working with internationally diverse teams on a broader range of issues.

International experiences
- o One of the COE's core goals is to educate and produce global leaders, and as such, the college aims to increase student participation in international experiences. Currently, of the first-year students who indicate an interest in spending a semester abroad, only one-quarter end up participating in a study abroad exchange, international summer coursework or a project with international exposure.
- o The college will work to increase the number of exchange opportunities and expand international experiential learning opportunities, for example internships and research. The college should also explore opportunities for international partnerships within the classroom setting, for example joint design projects.
- o To encourage an academic culture that values global engagement and awareness, the COE should reduce administrative barriers and increase financial support for student international travel opportunities.

EFFECTIVE TEACHING AND LEARNING COMMUNITIES

- *How can Cornell Engineering create more effective teaching and learning communities?*

COE aims to foster vibrant teaching and learning communities with its courses, programs, and departments — ensuring that students of all identities and backgrounds feel welcomed, encouraged and equally valued. Teaching policies and practices play a key role in building community vibrancy and supporting student wellbeing through both faculty-student relationships and peer-to-peer mentoring. By furthering the university's vision for student learning, COE will work to integrate more effective teaching methods and enhance a culture of respectful communication.

Through faculty training, course modifications and further investment in engaged learning programs, COE will boost the teaching and learning infrastructure to foster more positive environments. These efforts will ultimately support students' ability to demonstrate disciplinary knowledge, apply critical thinking skills and embrace community engagement opportunities.

Recommendations
1. **Provide training for more effective, inclusive teaching and mentoring**

The single most impactful thing COE can do to enhance undergraduate education may be to promote, support, and expect faculty teaching excellence. Achieving excellence will likely involve using known, effective pedagogy, as well as experimenting with approaches and trying different formats for courses. In addition to high expectations for teaching, this will require continuous efforts on the part of individual faculty to either be a better teacher or to mentor others. These efforts will be supported via workshops, individualized coaching, and peer mentoring.

COE should aim to create a series of trainings for faculty that provides research-based teaching methods that optimize learning outcomes, promote collaboration and inspire student engagement. These seminars should also emphasize the different ways in which people learn and communicate skills and knowledge. This ongoing series will later branch into topics about diversity and inclusion, interactive teaching, teaching technology, pedagogy and wellbeing in the classroom.

The college will start by offering these trainings to new faculty and then expand the programming to all faculty, with the expectation that they participate in at least one training per year. Every year, participating faculty should apply an improvement to their courses, and the COE will recognize these efforts through teaching excellence awards. Ideally, faculty would receive additional administrative support that gives them more time to focus on redesigning courses and fine-tuning their implementation.

It is important that student educators and teaching staff are also well prepared to create and maintain inclusive environments in every learning space, and the college should explore opportunities for providing them with appropriate development opportunities. For example, interested teaching assistants may be intentionally matched with faculty to help with course assessments and improvements.

2. **Increase opportunities for undergraduates to engage in learning communities**

Providing students with multiple ways to interact directly with their coursework helps create a thriving community — one that accelerates academic achievement and enhances students' sense of belonging. COE seeks to invest in more opportunities for first- and second-year undergraduates to engage in classroom-based and extracurricular learning communities, and there are already several successful programs upon which the college can build:

Introduction to Engineering classes (ENGRIs)
- o Currently, these classes allow first-year students to explore a key engineering topic before committing to a major.
- o COE should create additional ENGRIs that draw on two or three related majors and align with the college's priority research directions.
- o New ENGRIs should include a significant team-based project that allows students to work across skills, practice design principles, explore ethical questions and show how engineering disciplines translate in an applied setting.

First-year advising courses (1050s)
- o First-year engineering students already meet in set groups of 18-22 to learn more about the college's curriculum, programs, professional development opportunities, and university resources.
- o Faculty advisors can take ideas from the proposed training initiative and work to integrate more interactive learning opportunities and enhance community-building aspects.

Academic Excellence Workshops (AEWs)
- o Based on collaborative problem-solving, these weekly sessions supplement core classes in math, computer science, chemistry and statistics through optional, credit-based work.
- o COE should expand AEWs so that they apply to more courses, especially for second-years, and invest in program funding, staffing and training.

3. **Strengthen departmental programming to promote success within majors**

COE should further invest in department-based teaching and learning communities to build cohesion among both students and faculty. An ideal starting point is to create an onboarding program within majors so that students feel like they are stepping into a community when they choose their affiliation.

To encourage faculty to share effective teaching strategies, departments should work together to identify courses that can be revised to increase peer-to-peer learning and faculty-student relationships. This is particularly important in first-year courses, as well as for first-semester sophomores, who can benefit from curriculum-based community building efforts. The college should develop resources to support such innovations at the departmental level.

The college also aims to invest in developing new positions for engineering education specialists that can support efforts both within and across departments. These positions should include tenure-track, discipline-based education lines, as well as senior lecturers that serve as teaching fellows in the James McCormick Family Engineering Teaching Excellence Institute.

Additionally, creating a dedicated team of teaching support specialists will help coordinate resources for teaching and conduct organizational tasks associated with course improvements. This team will be particularly valuable in supporting faculty with large courses and can help respond to students' needs.

DIVERSITY, EQUITY, AND INCLUSION

- *How can Cornell Engineering keep diversity, equity and inclusion at the forefront of its community?*

A COE goal is to serve as a national leader in broadening representation, advancing equity, and increasing a sense of belonging among faculty, staff, and students. Its continual enhancement of policies and practices seek to support intersectional identities in multiple contexts, and it will explore opportunities for ongoing advancement.

This approach aligns with the university's legacy of recognizing that people with diverse backgrounds and experiences bring tremendous value to education, discovery, creativity and engagement.
As a fundamental part of its mission, COE will improve diversity, equity and inclusion efforts in the institutional framework it uses to educate future engineers. This will encourage graduates to work collaboratively and respectfully as they go on to address complex challenges at the local, national and global levels.

To advance institutional diversity, promote cultural competency and foster student wellbeing, the college will ensure that all students have equitable access to its myriad of resources and opportunities. These efforts underscore Cornell's approach to create and sustain an inclusive, egalitarian community in which all individuals and groups are included, valued and supported.

Recommendations

1. **Foster a diverse community of students, faculty and staff**

A crucial element of enhancing people's sense of belonging in a broad community relates to the visibility and representation of their peers with similar identities. By recruiting and investing in more diverse students, faculty and staff, the COE will create a positive feedback loop that continues to both attract and retain a wider variety of community members.

The college aims to expand its diverse class of undergraduates and ensure equal representation across all majors. Recruitment partnerships should be examined and further developed to support pipelines for incoming students from key communities — including Indigenous students and transfer students from community colleges – for example, by building upon the success of the existing high school summer programs to introduce a pre-junior program. The college should also invest in the pre-freshman summer program to support a higher number and broader range of incoming students.

Additional efforts should be made to fuel the faculty pipeline and to diversify teaching assistants. Increasing the accessibility of research to undergraduates serves to encourage careers in academia by offering insight into graduate and faculty level research. This work ultimately broadens the representation across all parts of the college and takes a soft culture approach to cultivating an inclusive, welcoming environment.

2. **Increase equity of resources and opportunities for all undergraduates**

It is mission-critical that all students receive access to the resources and support needed to achieve their goals. The college will streamline and increase availability to academic resources by improving web-based communications and by making sure that curricular policies encourage students to explore additional programming.

In tandem with university-level trainings, COE will also work with faculty to increase awareness of how instructional methods can shape equity in the classroom and other learning spaces. Departments and faculty members should also make it a regular practice to share educational resources with students — including old exams, syllabi and other classroom resources — to reduce inequities in access to knowledge.

Additional efforts will track retention and achievement across majors, and work with students to identify and overcome any roadblocks that stand in the way of their academic goals, such as access to office hours, financial support, supplemental curricular activities and other potential barriers. The

college will partner with existing student groups who are already working on issues of campus disparity and support their efforts.

COE will work to address these issues across the undergraduate community so that underclassmen and upperclassmen are equally supported. Investment should be made to increase financial assistance for students participating in co-curricular activities, such as internships, co-ops, research, study abroad, leadership and professional development opportunities, which may have hidden costs in terms of relocation, housing, transportation, project fees and ability to meet graduation requirements on time. Similarly, the college should highlight more engagement opportunities and also encourage student participation in non-competitive settings.

3. **Invest in inclusive teaching, advising, and mentoring for a variety of learning environments**

The college seeks to create a campus community where all students feel safe, welcome and encouraged to thrive academically, as well as personally. As such, it is paramount to set a standard among students, faculty and staff that shows how to cultivate positive, inclusive and meaningful interactions.

Everyone at COE should have the opportunity to take DEI training and to learn how it is relevant to their campus experience. For example, faculty should be required to attend DEI workshops that relate to teaching, advising, mentoring and research practices. Instructors can also leverage core classes and existing programs to offer DEI training for their students. Students in leadership roles throughout the college, for example peer advisors, team leads, and TAs, and tutors, are prime candidates for required training. T

The Engineering Leadership Program, as well as student groups, may also be able to help facilitate relevant sessions. Additionally, the college should seek to leverage and expand existing peer mentoring groups to build a stronger inclusive community. As part of the COE's commitment to providing inclusive classrooms and teaching excellence, it is necessary to create a public-facing statement that promotes and holds the college accountable to these efforts.

Both the mission statement and the DEI trainings should support a broad range of issues and be responsive to the ever-changing needs and conversations happening on campus and in society. Examples include, but are not limited to accessibility, disability, race, ethnicity, culture, LGBTQ+ identities, mental health, microaggressions, equity, as well as other backgrounds, identities and behaviors that have a profound impact on people's sense of safety, value and belonging.

STUDENT WELLBEING

- *How can Cornell Engineering help improve student wellbeing?*

COE seeks to supplement the university's broader efforts to foster an environment where student health and wellbeing are essential to their success at Cornell and in life. Through the [framework provided by the Cornell Mental Health Review](#), the COE will work to foster a healthy academic

environment, promote social connectedness and resilience, and increase help-seeking behavior to proactively reach people in need of care.

Within the college, the goal is to improve student support during key transition periods, evaluate the need for academic policy changes, explore more opportunities for community programming, and develop faculty and staff training that advances current health and wellbeing efforts.

Through these steps and regular evaluation, the COE will pursue a strategy that ultimately increases student wellbeing and their overall satisfaction with their undergraduate experience.

Recommendations
1. **Create academic policies that promote healthy learning**

A key part of the COE's ability to support students and their wellbeing relates to academic policies. The Cornell Mental Health Review already identified multiple areas that can be analyzed at the college-level, as well as at the university-level, to provide better institutional oversight of practices that affect student mental health.

Within COE, the College Curriculum Governing Board (CCGB) is the mechanism by which to identify priority recommendations, facilitate wider college discussion on those topics, and to recommend policy changes to the full Engineering faculty as appropriate. In addition to the academic policies identified in the Mental Health Review report, specific to COE is a reconsideration of the current credit limit policy and a review of the affiliation process.

Advising is another critical component of student success, and the college will work to make students better aware of the range of faculty, staff, and peers who are available for support. This effort of improved communications, along with the introduction of new targeted programming, will help reach students during transitional periods that have been reported as particularly stressful, such the start of freshman and sophomore years, transfer student matriculation, and post-graduation. Over time, the college can conduct departmental and course-based surveys to receive additional feedback about existing and emerging student needs, perform root-cause analysis and take an informed approach to pursuing supplemental changes.

2. **Promote social connectedness and resilience**

Student wellbeing thrives in an atmosphere of social connectedness, inclusion, and community and successes in Diversity Programs in Engineering are models for what this can look like across the college. The COE should develop a task force that examines the potential for community building college-wide, within departments, and through class teams, study groups and other peer-to-peer learning spaces. Particular attention should be given to key transitional periods. It is important that students have the chance to connect outside of competitive environments, and additional feedback from existing groups and clubs will provide more insight as to which elements provide the most positive experience.

The overarching goal is to create a community in which students feel included and supported and connected, and are better positioned to seek help when they need it.

3. Encourage student help-seeking behavior

Faculty and staff serve as role models for discussing behaviors and creating policies that promote positive student health and wellbeing. Their actions can affect how likely and how often students are willing to reach out in times of need.

To further understand how current practices are shaping students' experiences, the college will work with the university to review faculty and staff training opportunities related to mental health support, as well as diversity, equity and inclusion initiatives.

COE should create a training plan for faculty and staff that combines resources and best practices for enhancing student wellbeing. These materials should also include information about working with students from diverse demographics and backgrounds, which can transform peer-to-peer and peer-to-administrator interactions.

Over time, the college should strategically invest in ways to organize, communicate and incentivize new training opportunities, with the recommendation that faculty and staff be required to attend at least one mental health training every two years. This approach will create more positive relationships between students, faculty and non-teaching staff in administrative or service positions, who also have a critical impact on students' campus experience.

PROFESSIONAL EDUCATION

- *How can Cornell Engineering help students build skills that empower them to work collaboratively?*

In an era of rapidly evolving technology and complex global challenges, engineering has become a highly collaborative endeavor. This workforce benefits not only from technical knowledge, but from those who have a broad awareness and mastery of interpersonal and professional skills.

COE aims to build upon technical training by teaching students how to work across diverse teams, communicate effectively, think critically, and understand a wide range of values, motivations and perspectives.

Through these efforts, COE can become a leader in engineering education by establishing a framework that allows undergraduates to excel in both technical and non-technical settings — highlighting the important and dynamic roles that 21st Century engineers play in society.
Students should have access to relevant learning experiences throughout their undergraduate career, and the COE will integrate development opportunities with core coursework, co-curricular activities and

other environments. To underscore the importance of this skillset, the COE will eventually require its graduates to have reached a high level of competency in these professional areas.

This growing collection of educational programs will become a signature element of the engineering experience at Cornell and position graduates to flourish in the complex and competitive professional opportunities that await.

Recommendations

1. **Leverage existing professional programming**

Students already have frequent opportunities to practice working with diverse groups through engineering project teams, academic excellence workshops, collaborative coursework, faculty-mentored research groups and entrepreneurship initiatives.

The college also runs several programs that support the development of non-technical skills, including Engineering Leadership Programs, Engineering Learning Initiatives, Engineering Communications Program, Sue G. and Harry E. Bovay Program in the History of Ethics and Professional Engineering, and Engineering Entrepreneurship. The college will coordinate existing programs to build upon their success and strategically integrate new learning experiences where relevant. These programs align with the Cornell presidential vision of educational verve and civic responsibility, while upholding the university's culture of inclusion and belonging.

2. **Develop a framework to benchmark professional education goals**

To ensure that all undergraduates achieve mastery of non-technical engineering skills, COE will develop a comprehensive, systematic curriculum that provides reflective learning opportunities, hands-on activities and shares other forms of abstract knowledge as it relates to modern engineering.

This new curriculum will quantify a standard set of learning goals, which may be fulfilled in a variety of ways. Opportunities to advance non-technical skills should be integrated with existing classwork wherever possible so that students can maintain a balanced course load.

After piloting the program on a volunteer basis for 2-3 years, the college will incorporate it with existing graduation requirements. This approach will ultimately promote more thoughtful interactions in COE's overall learning community, increase student confidence and sense of belonging, and produce more successful graduates by giving them the hard and soft skills needed to navigate the professional world.

TEACHING INFRASTRUCTURE

- *How can Cornell Engineering improve undergraduate education through better teaching infrastructure?*

Teaching spaces support a wide range of student educational experiences. COE seeks to provide a fully-accessible, welcoming environment that fosters both collaborative and individual learning — helping students develop the necessary knowledge and critical thinking skills that prepare them to be successful engineers and leaders.

To become a leader in engineering education, the COE must meet the infrastructure needs of both the instructors and students who depend on classroom technology to communicate effectively, whether participating in-person or remotely. The college should also improve access to study spaces, maker spaces and computer labs to help students take advantage of additional opportunities to advance their studies independently, as well as with their peers.

Recommendations
1. Maintain a wide variety of teaching and learning spaces

COE should work to ensure that its classrooms support a multitude of teaching methods and that its study spaces offer the specialization that students need to further develop skills, practice creative problem solving and explore new aspects of engineering.

As the college moves into the next decade, it is experiencing an increase in undergraduate enrollment, as well as the need to maintain flexible learning environments for in-person, remote, and hybrid teaching in certain courses. Infrastructure investments should be made with the goal of supporting a wide range of teaching strategies that are effective in reaching a diverse student body through technology, accessibility, and general classroom size and layout.

COE should regularly evaluate how well classroom spaces are meeting the needs of different courses and make adjustments accordingly. It is important to make sure that faculty and teaching assistants have the necessary infrastructure to provide both traditional and alternative modes of course delivery — including the ability to record lesson and demonstrations, and cater content to a mix of in-person, remote and asynchronous participants.

Student study spaces are also an essential part of the learning experience. The college should further examine how many and what kinds of study spaces are available to both individuals and groups. This effort should also note the availability of specialized software, maker spaces or supplemental equipment.

Ultimately, COE will be able to better support students by developing a scheduling mechanism for these areas — helping ensure more equal access to this infrastructure, especially during times of limited availability or reduced capacity.

2. Manage spaces more effectively to match needs with infrastructure

To ensure the highest quality experience for both teachers and students, the COE will optimize the scheduling of classes, events, meetings and other uses of spaces through close collaboration between the Engineering Registrar's Office and the James McCormick Family Engineering Teaching Excellence Institute.

When courses have specific classroom needs, these spaces should be matched before students enroll so that the room reservation system can become more efficient. If certain courses only need an advanced level of infrastructure for a select period of time, the college should explore the possibility of booking high-demand rooms based on the necessary period of use and then relocate the course for the remainder of the semester.

To maximize the overall use of teaching space, departments should also explore opportunities for using this infrastructure during historically under-utilized times, such as late evening, and offering courses during summer session and winter session. More broadly, faculty should evaluate which instruction topics might lend themselves to an alternative structure or schedule, thus reducing the demand for standard, semester-long, classroom time and space.

When classrooms are not needed for teaching, additional efforts will be made to facilitate productive use of that space, and COE can gain additional insight for new opportunities by surveying students and faculty on their needs.

3. Empower instructors to teach more efficiently and effectively

The college should foster a knowledge-sharing environment that enhances classroom teaching and demonstrates the best practices for fostering student learning.

To help instructors focus on their students and the course content, the college should offer frequent training sessions to make them more comfortable utilizing the existing technology and infrastructure. This will improve the overall classroom experience for both teachers and participants, and reduce accessibility barriers within the space.