

The Development of a Texas A&M University Faculty of Engineering Education

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Dr. Karan Watson P.E., Texas A&M University - Corpus Christi

Karan L. Watson, Ph.D., P.E., is currently a Regents Senior Professor of Electrical and Computer Engineering, having joined the faculty at Texas A&M University in 1983 as an Assistant Professor. She is also serving as the C0-Director of the Institute for Engineering Education and Innovation. She has served in numerous roles at Texas A&M University, including: Provost and Executive Vice President(2009-2017), Vice Provost (2009), Dean of Faculties and Associate Provost (2002-2009), Interim VP for Diversity (2009 & 2005-2006), Associate Dean of Engineering (1996-2001), and Assistant Dean of Engineering (1991-2006). Dr. Watson is a fellow of the Institute of Electrical and Electronic Engineers (IEEE), the American Society for Engineering Education, and the Accreditation Board for Engineering and Technology (ABET). Her awards and recognitions include the U.S. President's Award for Mentoring Minorities and Women in Science and Technology, the American Association for the Advancement of Science mentoring award, the IEEE International Undergraduate Teaching Medal, the WEPAN Beville Watford Award, the College of Engineering Crawford Teaching Award, and two University-level Distinguished Achievement Awards from The Texas A&M University Association of Former Students—one in Student Relations in 1992 and in Administration in 2010, and the Texas Tech College of Engineering Distinguished Alumni. In 2003–2004, she served as a Senior Fellow of the National Academy of Engineering Center for the Advancement of Scholarship in Engineering Education. Since 1991, she has served as an accreditation evaluator, commissioner, Board of Director, then President of ABET, and is currently Secretary/Treasurer of the ABET Foundation Board of Directors. She has also served as a program evaluator for J.D. programs for the ABA, for universities' regional accreditation for SACSCOC, and for Business Schools for AACSB. She also has served as the Chair of the ECE division of ASEE, the President of the Education Society of IEEE, and the chair of the Women in Engineering of IEEE. She served as the Treasurer and a Board of Directors member for WEPAN.

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Abstract

Texas A&M University (TAMU) recently developed an interdisciplinary faculty group to foster and support research and innovation in engineering, engineering technology, and computer science education. TAMU's Faculty of Engineering Education is composed of members all across the university, including faculty not only from the college of engineering and the college of education but also from the colleges of business, liberal arts, and geosciences. The group supports collaborations for education research, curricular and pedagogical innovations, professional development, and mentoring current and future scholars in these fields. In a little over a year and during a pandemic, TAMU's Faculty of Engineering Education went from being a disparate group of individuals into a strong, cohesive community of practice. This paper will discuss the principles that drove the community's formation to ensure a strong sense of inclusion, solidarity, community, and promise.

Introduction

With the increasing demand for graduates with advanced STEM proficiencies, universities are increasingly strained to provide faculty and students with the resources and opportunities to meet those demands [1]. Engineering Education today cannot keep up with the dynamic classroom

environment and the ever-growing student population. Introductory classes continue to increase in size; however, the different teaching styles are not progressing in conjunction with this demand. As a result, numerous students perform poorly as they do not learn the essential engineering skills.

The American Society for Engineering Education (ASEE) reported that about 40% to 60% dropped out of engineering programs on average and that the highest dropout rates were among under-represented groups [2]. According to students, one of the top reasons for choosing to switch focus was not feeling a sense of belonging to their academic program [3]. Half of surveyed tenure/tenure-track faculty are increasingly concerned with research instead of teaching [4], creating a gap in student's education experience. There is an increasing awareness among researchers that course work needs to tie to industry-related experience [5]. Data from surveys have shown that 25% of professional engineers expressed that they overcame gaps in their formal education by relying on work-related experience [6].

Paper Overview

This paper describes in detail the steps that Dr. Karan Watson, prior provost, prior co-Director of the Institute of Engineering Education & Innovation, and creator of the Engineering Education Faculty, and Dr. Tracy Hammond, first Chair of the Engineering Education Faculty, current Director of the Institute for Engineering Education & Innovation, and Professor in Computer Science & Engineering, and others took in the creation of a formally approved Faculty of Engineering Education which became a tight-knit productive community. The rest of the paper is organized into a set of fifteen steps, with each step explaining both the actions we took and the outcomes.

Setting the Stage

Step One: Get the leadership of the college (deans and department heads) to agree that forming this faculty is not a problem.

Texas A&M University has one of the most prodigious engineering undergraduate enrollments in the country. TAMU was well-known in engineering education in the 90s but more recently has become more disparate. The recent politics of Texas A&M University are such that many senior administrators did not see engineering education on an equal footing to that of the myriad of "more technical" engineering disciplines. Additionally, as engineering education researchers spread across many departments and colleges, various departments feel that forming a group of faculty researchers in engineering education would impinge on their departmental goals. Thus the first step was to meet with the deans, associate deans, and department heads to agree that the Faculty's forming is not a problem and that it would actually be beneficial to their own programs and the university.

Step Two: Establish an agreement on where and how the faculty would be hosted and administered.

As faculty who participate in engineering education research are found in many different departments and colleges, it was not obvious where the Faculty should be housed. Additionally, several senior administrators unfamiliar with engineering education did not understand why the College of Engineering would house engineering education instead of the College of Education and Human Development. Providing examples of other peer institutions such as Purdue University and Virginia Tech, both of which house their engineering education departments in the College of

Engineering, set a precedent for Texas A&M University. Additionally, several of the nation's top experts in engineering education serve on our College of Engineering's advisory board. We asked for their input to be provided to senior administration in the College of Engineering. Eventually, it was decided that the Faculty of Engineering Education would be housed in the College of Engineering. While any department could confer degrees that produce new knowledge in engineering education, only the Department of Multidisciplinary Engineering can confer a degree in pure Engineering Education through the Interdisciplinary Degree program in the College of Engineering. Quality control for these theses or dissertations is handled by the new Department of Multidisciplinary Engineering in the College of Engineering. This faculty is administratively located in the Institute for Engineering Education & Innovation (IEEI), a joint institute of Texas A&M University and Texas A&M Engineering Experiment Station. However, the IEEI is not a department, and each faculty in the Faculty of Engineering Education has a home department. Thus, the Engineering Education graduate students might have a degree either from the Department of Multidisciplinary Engineering or the faculty's home department. While a handful of faculty have full-time positions in the Department of Multidisciplinary Engineering, the majority of faculty have joint or courtesy appointments. The Department of Multidisciplinary Engineering confers, predominantly, the Interdisciplinary Masters and Doctoral degrees, and the Bachelor degree in Multidisciplinary Technology. In order to advise a student graduating with an Interdisciplinary Degree, the faculty must have a full, joint, or courtesy appointment with the Department of Multidisciplinary Engineering.

Step Three: Involve the appropriate voices to get a preliminary understanding of what the PhD, MS, and DEng degree plans would look like.

If degrees are going to be grantable in the topic of engineering education, it is important to establish what an acceptable degree plan would look like. There were numerous questions raised about the efficacy of the plan:

- What types of applicants would be admitted to the program?
- Would graduate students be required to have an undergraduate degree in an engineering discipline?
- What would the curricula and courses look like?
- What would be the balance of education and engineering classes?
- How many engineering courses would be required for it to remain in the engineering school?
- What skills in education would be required, recommended, and/or beneficial?
- What would a Ph.D. qualifying exam be like?
- What other skills would be useful, such as math, statistics, qualitative and quantitative data analysis skills?

In the end, Dr. Karan Watson worked with the curriculum experts in the Interdisciplinary Degree program to determine what a degree plan would look like. The interdisciplinary program has graduated top engineering education people in the past, including Dr. Stephanie Adams, Dean of the School of Engineering and Computer Science at University of Texas at Dallas; Dr. Kristi Shryock, Director of the Craig and Galen Brown Engineering Honors Program at Texas A&M; Dr. Debra Fowler, Director of the Center for Teaching Excellence at Texas A&M; Dr. Kelvin Kirby, Associate Professor of Electrical Engineering and Deputy Director of the Center for Radiation Engineering and

Science for Space Exploration at Prairie View A&M University; and Dr. Tanya Wickliff, Professor of Engineering Practice at Texas A&M. Many of these are graduate exemplars in engineering education today, and those various degree plans helped to serve as a model for the program. This discussion ultimately resulted in a refocusing of the interdisciplinary engineering program at the undergraduate and graduate levels to develop their foundation in engineering skills while customizing their degree's focus to incorporate engineering education. The Bachelor of Science in Interdisciplinary Engineering follows the same overall structure as other engineering degrees at Texas A&M University to ensure students get a thorough foundation in physics, chemistry, and mathematics before advancing to more specialized topics. Interdisciplinary engineering students will select technical courses with the Interdisciplinary Engineering Advisory Committee's consultation and approval to create specialized degree plans for emerging technical fields or interdisciplinary focuses. More specifically, students work with their advising committee to customize 58 of the 128 hours required to earn a Bachelor of Science in an engineering discipline at Texas A&M University. This design enables truly multidisciplinary degree plans beyond what students could achieve with just a minor. The Master of Science and Doctor of Philosophy in Interdisciplinary Engineering similarly design their own degree plan that suits their educational goals with a consultation with their thesis advisor and the Director of Interdisciplinary Engineering Programs. Graduate degrees at Texas A&M University inherently give students the freedom to select courses that match their specialization with only a few required courses related to their field's foundation. In the case of interdisciplinary engineering, these fundamental courses are mathematics and statistics. Additionally, Dr. Tracy Hammond met with Dr. Donna Riley from Purdue and Dr. Stephanie Adams for UT Dallas shortly after becoming the first Chair of the Engineering Education to gain insight into what makes an effective Engineering Education Program. Graduate students in the Engineering Education Department are currently interviewing current and past students and faculty of the program to gain further insight.

Step Four: Create a preliminary draft of the bylaws and have them reviewed by the relevant members of the administration.

When forming an official Faculty that would be recognized by the university, there needs to be official bylaws that are approved by the university. At Texas A&M University, these would eventually need to be approved by the Director of Interdisciplinary Engineering Programs and the Executive Associate Dean of Engineering, so we included them in the process. Our bylaws included 10 articles:

1. Description

An interdisciplinary faculty composed of members from various departments and colleges across Texas A&M University.

2. Purpose

Provide a collaborative structure for faculty interested in research and innovation for engineering, engineering technology, and computer science education.

3. Membership

Faculty members will have a degree in engineering, computer science, or engineering technology, significant industry experience, or a degree in education.

4. Executive Committee

Seven elected members of the Engineering Education Faculty.

5. Election of the Executive Committee

Elections are handled by email ballots.

6. Function of the Executive Committee

Determine and implement guidelines for the good of the Faculty and represent the interests of the Faculty to the University.

7. Function of the Officers

Chair - Chief officer and representative of the executive committee.

Vice-chair - Servers in the capacity of the Chair in the absence of the chair.

8. Meetings

General Faculty meeting annually - April.

Executive Committee meetings will be a minimum of three times per year.

9. Committees and Taskforces

Approved by the Executive Committee and populated by the chair.

10. Amendments

A means to amend the bylaws.

Forming the Faculty

With the deans, associate deans, and department heads' support for the Faculty agreements on where and how they would be hosted and administered, the task became filling the Faculty's ranks and agreeing on the bylaws. The invited members would need to add value to the engineering education faculty and accurately reflect the college's diversity. These new members would then be asked to discuss and vote to ratify the bylaws that detail their membership requirements, the executive committee's function, and establish basic rules for facilitating the faculty's management.

Step Five: Find the appropriate faculty that will add value to the Engineering Education Faculty.

Initially, to find the relevant faculty across the university who should be part of the Faculty of Engineering Education, Dr. Karan Watson reached out to each of the department heads for suggestions. However, often instead of getting a list of faculty who excelled in engineering education research, she received a list of faculty members whom the department heads thought had slowed in research production and thought this would be a way to get them to start being productive again. This was not the way to attempt to build a world-renowned Faculty in Engineering Education. Thus, in April of 2019, Dr. Karan Watson, Co-Director of Texas A&M University's Institute for Engineering Education, sent a proposal call out to the university as a whole to find relevant faculty members who would be interested in being part of an officially recognized University Faculty of Engineering Education complete with bylaws. In that open invitation, she detailed that the principal purpose of forming this Faculty was to provide a collaborative structure for faculty of the university who have interests in researching, developing, or sharing innovations for engineering, engineering technology, computer science, and industrial distribution education. The collaborations are primarily involved in education research, curricular and pedagogical innovations, professional development, and mentoring of current and future scholars in education in these fields. Despite how engineering education had fallen out of focus at the university, many faculty responded, stating they had an interest in this initiative.

The bylaws state, "Generally, the Faculty will consist of faculty members who have a degree in engineering, computer science, or engineering technology, and a graduate degree, or significant

industry experience, in one of these fields or education.” The Executive Committee determines admissibility but requires consent of the department head, or the department head’s designee, of faculty members’ administrative location. Other considered faculty includes those who are actively involved in education research in these areas or have demonstrated significant development or innovations. While the majority of the faculty are in the College of Engineering, we have a significant presence from the College of Education and Human Behavior, the College of Liberal Arts, and TAMU Academies, as well as faculty, affiliates, and student members from the College of Geoscience, Mays School of Business, Bush School of Government & Public Service, School of Law, the College of Architecture, the Sterling-Evans Library, and the Qatar Campus. The list of formally recognized faculty members (without the affiliates and students) in the Faculty of Engineering Education and their distribution in the colleges and departments are displayed in Figures 1 and 2.

Figure 1: Number of Formally Recognized Engineering Education Faculty by College

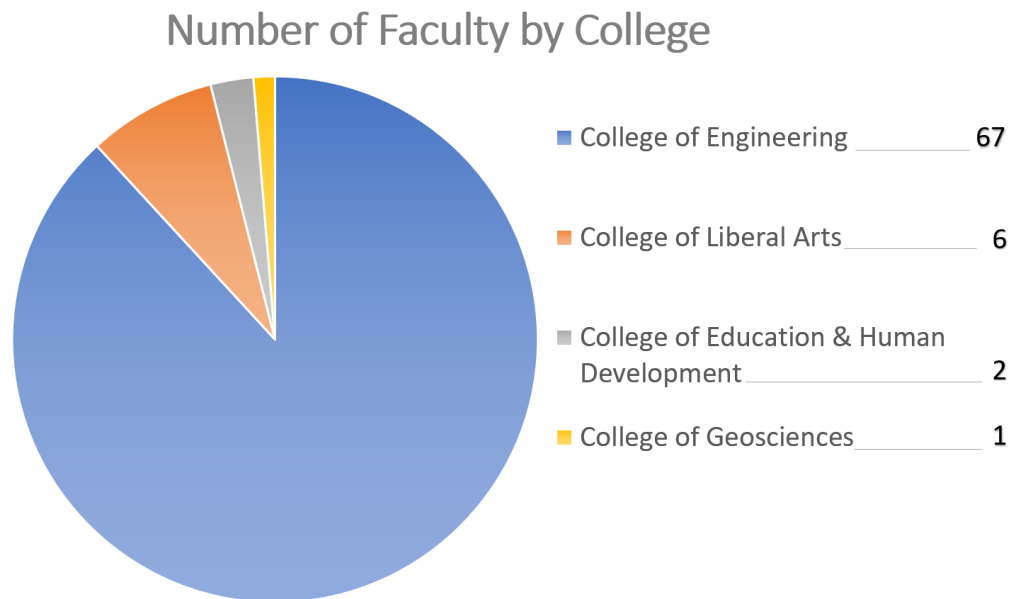
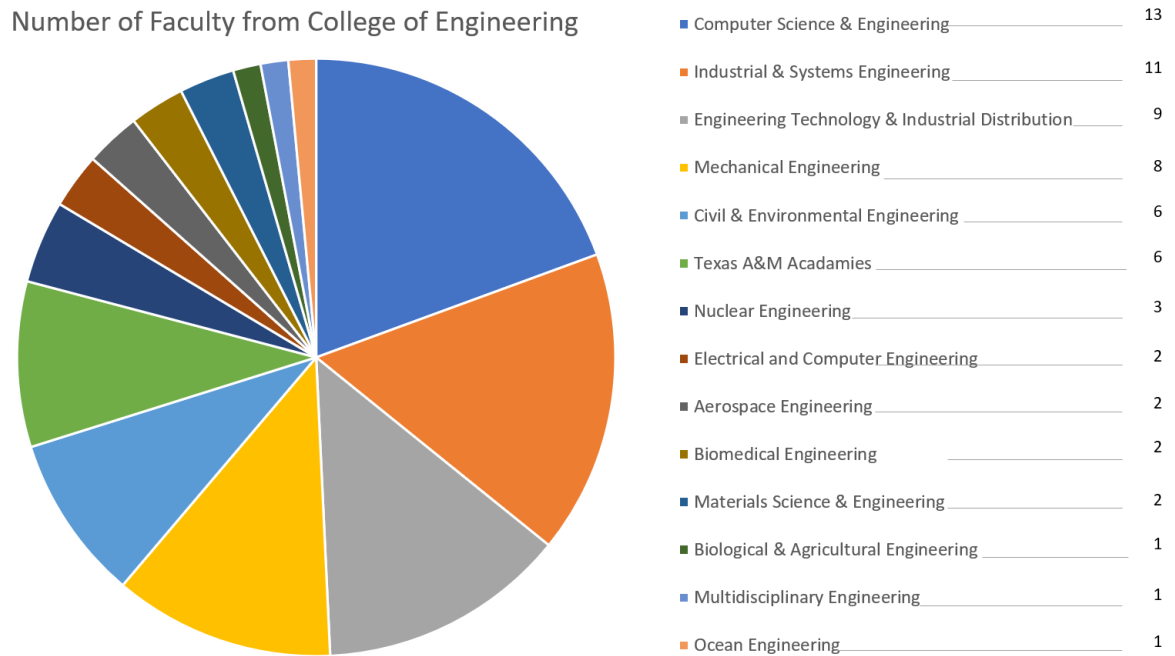


Figure 2: Number of Engineering Education Faculty in the College of Engineering



Members of the Faculty will maintain engagement with the Faculty in alignment with their rank and responsibilities in their primary administrative locations. A table of these engagements are shown in the table below. Each member is expected to meet all of the required engagements and one or more of the optional engagements in the three year window.

Table 1: Example required and optional (encouraged) engagements to maintain membership in the Engineering Education faculty (frequency is in the 3 year window)

Activity or Outcome	Frequency	Req/Opt
Attend Engineering Education Faculty Meetings (in person or virtual)	3	R
Serve on a Standing Committee or taskforce for Engineering Education	1	R
Chair a graduate committee of Engineering Education	1	O
Publish work in Engineering Education	1	O
PI or CoPI an externally funded program in Engineering Education	1	O
Deliver a workshop or short course, locally, system or state level or nationally for Engineering Education	1	O
Election to a national leadership role in Engineering Education	1	O

Teach a course focused on Engineering Education	1	O
Participate in a faculty development program that is at least 4 hours	2	O
Formally propose (alone or with colleagues) a scholarly-based innovation to any course being taught to the unit that offers the course	1	O
Participate in a community of scholars event focused on local faculty course innovations	2	R

Step Six: Agree on the set of bylaws.

In September of 2019, the Faculty met for the first time as a group, with approximately 41 faculty participating in that initial meeting. One immediate benefit was bringing together many of the faculty members interested in Engineering Education that were dispersed across multiple departments. Even in this early stage, a community was starting to form. During the meeting, members proposed and discussed potential bylaws for the group. In October of 2019, the Faculty voted on a set of bylaws and agreed to nominate an executive committee. The committee would determine and implement guidelines for the Faculty's good and represent the interests of the Faculty in general when called upon by the University, Colleges, Departments, and other agencies. Additionally, they are also tasked with considering potential courses, certificates, minors, and degrees to serve the Faculty's goals and interests. To that end, the committee must propose where these programs should be administratively located, guide the development and implementation of the programs, and assess students' admissibility to programs when asked. Lastly, the committee is tasked with planning and facilitating collaborative activities among the Faculty. After the bylaws get approved for our most recent amendment, we will post them on <http://ieei.tamu.edu>.

Step Seven: Form a representative and balanced executive committee and select a chair and vice-chair.

The bylaws state that "The executive committee would consist of seven elected Members of the Faculty of Engineering Education (but excluding any faculty member who is enrolled in a degree-seeking program), inclusive of the two leadership positions of Chair and Vice-Chair." The intent was to have a diverse committee with no more than two faculty with the same primary administrative located department. Those elected shall serve three years, beginning on September 1 of the year elected. Initially, all seven to be elected in fall 2019, with two having 1-year terms, two having 2-year terms, and three having 3-year terms. The elected committee members would then select a chair and a vice-chair for three-year terms. These leadership appointments supersede the previous terms of election to the executive committee. If applicable, new members elected to the executive committee will first fill the remainder of the term duration for the Chair and Vice-Chair. Additionally, the executive committee would fill vacancies in its members or offices between the annual elections.

In November of 2019, the Faculty voted seven members to form the executive committee: Dr. Luciana Barroso, Dr. Kelly Brumbelow, Dr. Jean-Francois Chamberland, Dr. Dilma DaSilva, Dr. Tracy Hammond, Dr. Michael Johnson, and Dr. Kristi Shryock, all from the College of Engineering. The executive committee then voted Dr. Hammond as Chair and Dr. Shryock as Vice-Chair. As their first mode of action, they voted to change the bylaws to ensure inclusivity across the university,

requiring at least one member from each College with over five participants, of which the College of Education and Human Development did have, but without representation. In December of 2019, the Faculty of Engineering Education ratified the amendment and added Dr. Michael De Miranda to the Faculty.

Form Priorities

Step Eight: Jointly agree on a set of priorities.

The Faculty of Engineering Education span a wide range of research interests in Engineering Education [8-81], including:

- theoretical areas such as tenets of the learning sciences which include but are not limited to: learning is contextualized, learning requires optimal challenge, learning is making, situated learning and community of practice, learning requires iteration with multiple perspectives, learning is becoming, learning is distributed and interactional, learning is interest-driven, learning is metacognitive, learning is the exercise of imagination and creativity, learning requires agency and autonomy, and learning requires discipline-agnostic skill development;
- practical areas including faculty development, change management, diversity and retention, as well as classroom implementations of the theoretical constructs;
- and technological advances that improve education in engineering using sketch recognition, eye tracking, artificial intelligence, ITS applications, and many others.

In December of 2019, the Faculty jointly came up with a list of priority agendas and a list of taskforces. It was important to involve the Faculty in setting these to give them ownership in the group. Priorities included ways to give broader exposure for the research and innovation work of the Faculty, to support and encourage the Faculty in that work and in their teaching roles, and to serve other groups in the university and the community.

In January of 2020, eight different taskforces were formed. As faculty expressed interest in different taskforces, Chair and Vice-Chair were assigned and interested faculty were invited or assigned to join the group. Each group set goals and kept meeting minutes that were recorded and made available to all members of the Faculty. The resulting localized agendas and priorities from these meetings are described in the following table.

Table 2: Taskforces and their Goals

Taskforce (TF)	Goals
Awards Taskforce	Communicate with the Teaching TF and the Research TF for input Communicate with each of the departments for input ASEE awards IEEE teaching awards

Information Taskforce	Gain information about the successes of the faculty Produce a newsletter each month Work with Research TF to help with Facilities statement
Development Taskforce	Meet with the development office Develop a plan for sustainability
Keep Moving Forward Taskforce	Develop a schedule of seminars, workshops, discussions Work with the Research TF to get ideas for research-specific seminars Work with the Teaching TF to get ideas for teaching-specific seminars
Departmental Engagement Taskforce	Find a representative from each department Determine how best to be successful in each department Introduce the group to each department Ask the question: "How do we bring value to the departments?"
Research Taskforce	Aid matchmaking for grant proposals Produce facilities information for grant proposals Work with Teaching TF to get evaluation standards for EHR grant proposals Determine what other grant proposal assistance would be helpful Identify potential stories for newsletter related to research Propose research-related seminars and workshops to Keep Moving Forward TF Identify upcoming research opportunities and report to the newsletter TF
Teaching Taskforce	Facilitate peer-review of classroom activities Facilitate teaching-related matchmaking needs Provide suggestions to the awards committee Provide suggestions of teaching-related content for the newsletter
Engineering Research Agency Certificate Taskforce	Create the Engineering Research Agency Certificate Decide the classes to be developed or required Complete process for a recognized Engineering Research Agency Certificate

Respond to Urgent Needs of the Faculty

Step nine: Be flexible. Needs change. Remember what is important.

In March of 2020, with many taskforces only having met once or twice, COVID hit. Many of the Faculty had families on the front line. All of us were overwhelmed, now having to completely rework our face-to-face class into an online setting in a compressed amount of time. The instinct was for everyone to step back, but rather we took this time as a priority to press in and band together to use our expertise to help the Engineering Faculty as a whole. In mid-March, we transformed from meeting once a month to once a week. These weekly meetings were pivotal to creating a tightly-knit community. They became a lifeline for many faculty as we all needed additional peer support through

this emergency transition in instruction.

With the faculty in place and committed, we had an immediate resource for continuing teaching while everything was changing around us. As some faculty encountered issues, usually another had found a solution or workaround. This would spread through the faculty, and those faculty could also share with their departments. We discussed a wide range of topics, from how to engage students and create support systems and safe places for learning for them to practical strategies for managing an online synchronous class session to addressing current world events in our teaching. Meetings frequently kept the sessions highly relevant to a rapidly changing teaching landscape.

Creating a Community

Step ten: Strengthen the community. Create several smaller communities that span across multiple departments to create a powerful and tightly webbed network.

In the beginning, we focussed on supporting ourselves and others in this transition, but by the end of the summer, it had transformed into a tightly knit community that formed two writing groups and produced two surveys (with over 5,000 total responses) to query, reflect, and respond appropriately to the needs of the faculty, students, and staff [82]. A Collaborative Etiquette Agreement paper was also produced to give other faculty a starting point on etiquette in the virtual classroom [83].

The Engineering Education Faculty's weekly meetings have ranged from hearing prominent speakers from around the country on their role in engineering education, book reviews on current educational resources, and open discussions on the current state of teaching online. This diversity and ability to be a part of the group has added to the tight-knit community we have developed. Multiple daily writing groups have been created to provide faculty with a small group to meet with. Usually, the meetings are one hour, writing for twenty-five minutes, taking a break, and writing again. The focus gives you a set time to complete work, get feedback on a project or paper, or help others. These groups have reviewed publications, applications to programs, presentations, and other items that the group members are working on. With the community of practice forming, resources are available to build an informative web presence that will allow others in Texas A&M University and the broader Engineering Education community to know what we are doing and how we can continue our goals.

A Focus on Developing Initiatives

Step eleven: Remember the core goals. Create initiatives that will help you accomplish the ultimate goals of the Faculty. Be clear about the desired outcomes, plan the initiatives to achieve those outcomes, and make sure to follow through on the outcomes.

In September of 2020, the executive committee, in conjunction with the Institute of Engineering Education and Innovation, now directed by Dr. Tracy Hammond, started an IEEI/EEF Teaching Faculty Fellows program, an IEEI/EEF Research Faculty Fellows Program, and an IEEI/EEF Seminal Speakers program.

The Teaching Faculty Fellows meet weekly to watch each other's classroom videos to help transform their online teaching practices and develop a better understanding of how to evaluate online teaching. Participants come from different engineering disciplines, spanning different levels of teaching experience from less than three years teaching to more than 30 years in higher education, and

were assisted by two advisors from the university's Center for Teaching Excellence. After receiving training on how to observe and evaluate a class session, the group watched and commented on short parts of classroom videos of 2-3 participants each week. The group also focused on personal strength building, designing impactful teaching resumes, and building descriptive and appropriate teaching philosophies. Faculty realized that more than better presentations, what made them a better teacher was more empathic teaching and the creation of an inclusive classroom. The teaching fellows are currently writing up their results for FIE submission.

The Research Faculty Fellows meet weekly to plan and design classroom experiments in their own classroom, write NSF proposals, and give feedback on each other's work and publications. Many of the participants found the training on how to write strong research proposals highly valuable and commented that the group provided valuable insight and feedback into the proposal writing process. The grant writing training includes tips and guidelines for how to write a research proposal, plan a timeline, budget the project, involve the best collaborators, and create project management and personnel documents such as a biosketch and facilities description. Each participant is passionate about improving Engineering Education in their field in some way, e.g., improving diversity inclusivity, making resources for learning STEM topics more accessible, and improving assessment of complex cognitive skills such as creativity. That said, all of the projects included a heavy focus on creating a more inclusive classroom to increase the engagement and retention of engineering students. Several of the proposals will be submitted this month.

Once a month, the Seminal Speaker Series invites a seminal speaker in Engineering Education to a public talk on the state of Engineering Education. The speaker also met with several smaller groups, including the associate deans and department heads, the teaching fellows, the research fellows, the Engineering Education faculty, the Engineering Education executive committee, and the graduate students. Thus far, our speakers have included Dr. Stephanie Adams, a prior president of ASEE and Dean of the School of Engineering and Computer Science at UT Dallas; Dr. Donna Riley, the Dean of the School of Engineering Education at Purdue University; Dr. Beville Watford, Associate Dean of Equity and Engagement at Virginia, and Dr. Cindy Finelli, Director of Engineering Education and Founding Director of the Center for Research and Learning in Engineering at the University of Michigan. Dr. Sheryl Sorby, current ASEE president, is on the docket for future speakers. The speaker series, with a participation of approximately 50 faculty and students on average, explores how to rise to the challenges of our day, introduce engineering in a way that is inclusive for all students and discuss the future of Engineering Education as a whole. This series's notable outcome is the increased engagement of Engineering Education faculty and students, strengthening ties and creating the foundation for collaborations across departments.

Create a Community of Practice to Support the Graduate Students

Step twelve: When creating a new Faculty across many disciplines, that means that the students are also disparate. Create a sense of community for your graduate students.

The Faculty of Engineering Education group's creation also marked the first time that graduate students ever knew that other students interested in Engineering Education existed. For each Seminal Speaker, the IEEI facilitated a one-hour student-only discussion where they could ask career advice or other topics to well-known experts in Engineering Education. They often come to many of our faculty events and workshops and are treated as peers at our meetings, especially since several of our APT or PoP Faculty in Engineering Education are also PhD students getting an

Interdisciplinary Degree with a focus in Engineering Education; thus, it is quite common for our peer faculty to also be our graduate student advisees. Although graduate students are welcome in our faculty meetings and events, it is important to support our graduate students in their progress to complete a degree. Having a community of their own is crucial to that endeavor. The IEEI started that community through the seminal speakers series student discussion, where many of them realized for the first time that there were others like them, but we expect (and will facilitate as necessary) this group to become independent and form their own taskforces and directives, regularly meeting independently.

Support Diversity

Step thirteen: Creating a culture of inclusion is probably the most important part of engineering education, and in creating a successful classroom and culture. People cannot learn if their mind is not in the right place.

When you are building a culture, make sure that persons of color are leaders in the community. Additionally, provide them with opportunities to educate the Faculty on how to create a community of inclusion. Create initiatives that support diversity and inclusion. Focus both on initiatives that support diversity and inclusion in your community and in the classrooms of the persons in your community. The IEEI conducts a weekly reading group on race and inclusion for students and faculty. They listen to one chapter each week of Emmanuel Acho's book, "Uncomfortable Conversations with a Black Man," then discuss the contents of that chapter and its implications on engineering education. So far, the faculty and student groups each have over 80 registrants.

The Engineering Education Faculty have shared advice supporting diversity through the IEEI's various programs; this includes:

- Random breakout rooms on particularly tense days.
- Read any poignant official notices put forth by the University President or other top officials.
- Faculty can provide empathy, support, and thoughtful awareness in the classroom without proselytizing to or unduly influencing the students.
- Most engineering students do not take non-engineering classes, so they don't have a place to safely discuss diversity and inclusion.
- The IEEI can help non-Engineering Education faculty who still have some fear or questions about their own classroom.

Faculty should refrain from espousing political views. That said, they should not stop being empathetic with the students as they deal with difficult times and emotions. Often, the best mode of action is to provide them with a Google Form during classes with the following two questions, "As engineering faculty, what can we do to help you?" and "I recognize that this is a tense time for many people, with COVID, politics, unrest, and class deadlines causing many students to have heightened anxieties. Feel free to use the space as a private space to rant about whatever is bothering you now, without any judgment." Generally, the students spend time venting about different things and then thanking the faculty for giving them a space to express themselves and for acknowledging their feelings. Students express how it made them feel better or even say that the form helped them realize that there are people who care about them.

Sample Classroom Discussions by Dr. Tracy Hammond in CS data science & machine learning course are as follows:

- George Floyd—Asked 92 students about what engineering faculty should do in a Google form; 87 said engineering faculty should discuss it in the classroom. Used the data to teach qualitative data coding.
- Juneteenth—Read the statement by the university president about Texas’s history and what our state was now doing, put students in random breakout rooms for 5 minutes. Students said it was “cathartic.”
- Protests—Students brainstormed a potential capstone project to aid the protesters. 10 students listed that as their preferred project. The project was eventually not chosen, as students worried about potential privacy implications.
- Justice Ruth Bader Ginsburg’s death—Asked students to discuss how her death is relevant to their projects. After initially having difficulties conceptualizing the discussion, all teams came up with poignant solutions. The class further discussed the potential market value in being able to come up with timely solutions that benefit society.
- Elections—Asked students about anxieties around election and what innovations could be useful.

Other faculty have discussed other events such as :

- Hispanic Heritage Month—Asked students if they knew any famous Hispanic Biomedical Researchers. One student responded, “hopefully me one day.” Presented a list of several famous Hispanic Biomedical Researchers and their contributions. The last one directly led into the current discussion of the day. Several students mentioned on their end-of-semester evaluations how much that meant to them.
- Black Heritage Month—Identified several key Black contributors to the field of Computer Science that created technologies the students would resonate with. Asked students to pick their favorite contribution, then showed them the people behind them. Held a discussion about what it would be like if those contributions. Presented the data on the difference between the distribution of the US population and those holding Computer Science jobs. Of the students, 34% were surprised by the data. Many students (77%) reported being open to the discussion. After class, one student reached out to the instructor to say how much they appreciated the conversation because they often struggle with figuring out ways to share Black history themselves. It inspired them to dig deeper into the topic.

Outreach

Step fourteen: Make a plan to reach out to the departments and the various university programs as a whole to help them.

It is important to document your successes and value to the university as a whole and present the information regularly. We broadly emailed our initiatives, target-emailed particular people of value, and presented to departments, faculty senate committees, our council of principal investigators (CPI), and anyone who showed interest.

Keep Moving Forward

Step fifteen: Creating something new, cohesive, coherent, valuable, and sustainable across a university is never easy. It is important to keep moving forward through adversity. Continue to reflect and reenvision your strategic plan.

COVID happens. Classes happen. People are busy. People have lots of different needs. Make sure that you continue to supply something of value to your constituents. People will not come just because you tell them to. They will come because it is good for them. A Faculty is a community. It is only as good as what people put into it. That will mean that you need to have a few core people who put extra effort into it so that there is a solid base when others stop by to check it out.

Advice

This Faculty was initiated by Dr. Karan Watson, a prior provost and dean of faculties of Texas A&M University. As such, she knew who best to contact at the university to start a Faculty of Engineering Education. This type of faculty development could be a dangerous on-taking for an Assistant Professor without significant backing from upper administration. It is vital to articulate the value to the school and the value to the community the value of the community. Additionally, gain the attention of trustworthy people in positions of power that can be trusted to give continuous feedback.

Summary

In a little over a year and during a pandemic, the Faculty of Engineering Education went from being a disparate group of individuals into a strong, cohesive community of practice. This paper discussed the principles that drove this community's inception and to ensure a strong sense of inclusion, association or solidarity, and promise.

Future Directions

Now that we have a cohesive faculty, future goals for the Faculty are as follows:

- Have a greater presence at ASEE, FIE, and other engineering education conferences to become integrated with the nationwide engineering education community.
- Create a cohesive online presence to have a single place where researchers can learn about our research and instructors can gain from our evidence-based practices and research.
- Identify the core strengths of our exemplary faculty. Highlight and develop those strengths.
- Provide resources to support grant proposal writing.
- Establish a roadmap for engineering education students.
- Measure equity/diversity/inclusion and come up with plans to improve
- Develop a sustainability plan that includes donors and grant funding.

Acknowledgements

This work could not have been completed without the strong accomplishments of the individual members of the Engineering Education Faculty, especially Dr. Jonan Donaldson. Additionally, the Dean's office has supported us through this change, especially Dr. NK Anand, Dr. Harry Hogan, and Dr. Mark Weichold as well as the department heads, especially Dr. Tim Jacobs. As always, we appreciate the support of the Sketch Recognition Lab has been a foundational force.

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