

Symposium on Imagining the Future of Undergraduate STEM Education
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Submitted stories from symposium participants on the topic of
Envisioning the Future Role of Faculty and Staff

Karen J Castle
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In 2040, courses are led by interdisciplinary* teams of faculty and staff who will be better described as guides or mentors than professors/instructors. Faculty will focus on building community and creating a learning environment that supports all students. The students themselves will have more opportunities to be creative and will work with faculty to design their own educational experiences. Assessment of student learning will be much more flexible than it has in the past and students will play a greater role in that assessment.

*What is meant by the term “interdisciplinary”? Will the instructional team be more multidisciplinary than interdisciplinary such that there is depth in multiple, but separate fields? Or have they all been trained in interdisciplinary programs that exist in spaces between traditional disciplines? Movement in either of these directions is better than the traditional isolated and siloed approach to teaching, but undergraduate education will look quite a bit different depending on which way this evolves.

Jennifer Cole
Assistant Chair Chemical and Biological Engineering
Northwestern University

Before the changes of the College Education Act of 2022, students used to sit in chairs and listen to professors. That seems strange now, since our community doesn't have “teachers” and “students,” but rather collaborative learners and designers. The learners and designers are full participants in the creation of their degree path as well as collaboration experiences with faculty and peers.

Courses and learning are no longer siloed. Learning happens at the intersection of student project interests, societal issues, and learner & faculty expertise. There is collaboration between learners and faculty mentors, industry partners, researchers, and

the community. The educational experience involves solving problems important to the community.

The amount of learning gained is determined by the learners. Learners are taught techniques to reflect, journal, and gain awareness of what they have learned. They have a hand in their own assessment.

Compensation for mentors (faculty and peers) is commensurate with level of participation and ability/effectiveness.

Elizabeth Dirk
Associate Professor
University of New Mexico

Welcome to 2040. Believe it or not, we are not going to a classroom. Faculty now meet with small groups of students not to lecture, but to act as mentors as students embark on addressing key social issues important in their communities. Faculty, as mentors, work in partnership with other faculty, members of industry and other members of the community to work alongside the students. Faculty and students have at their disposal a library of modules of core STEM topics when students get stuck on foundational ideas. This way, it does not matter what knowledge a student comes in with, they can equalize with the modules. This set up allows students to go at their own pace. When they complete a level, they can move on to the next. Students will receive badges/ certificates as they complete certain tasks to inform potential employers what skills were gained. Milestones in their projects will be assessed through self assessment and by their peer groups.

Mario Gomes
Senior Lecturer
Rochester Institute of Technology

A successful undergraduate STEM education of the future will empower students to become owners of their education. Faculty will need to be guides and students will need to take initiative. This will require a change in the roles of faculty as well as students. This role change has both subtle and profound aspects. Faculty will need to think of themselves as resources and guides to help the students find the solutions to problems that the students want to solve instead of problems that they are told to solve. Faculty already guide students to a deeper understanding of concepts but often students have no idea why they are learning those concepts at all. This lack of understanding about

why they are taking the classes can reasonably result in low motivation, poor performance, low retention, etc. If the focus of the students' learning can instead be centered around problems that they want to solve (be those student generated or faculty proposed) then the framework for learning can shift from something the student is required to learn to something that they want to understand so they can solve a problem they care about. Faculty are skilled in assessment but in the future students will need to be involved in assessing their own work because they will need the skill of "determining what they know and what they don't know" as they transition to lifelong learners. Opening up the assessment to involve students would give a different perspective. Traditional assessment is based on outcomes without an understanding of the process used to achieve those outcomes. As an example, 2 students both get the same grade on an assessment (test, project, HW). However, the process that each student used to learn the material and perform at that level may be widely different (study groups, office hours, practice problems, online resources, etc.). That learning process is currently hidden in the traditional model. In the future, Faculty take an active role in helping students assess their own ability to learn, not just the outcomes from that learning.

Lisa Lewis

**Professor, Department of Chemistry & Biochemistry
Albion College**

I have spent over a quarter of a century contributing to higher education from a liberal arts college as a professor, a department chair, a director of an interdisciplinary honors program, an associate provost, a director in the Admission Office, a leader in local and national faculty development initiatives, and a AAAS Science & Technology Policy Fellow. I am successful in teaching integrated chemistry classes that are in demand by diverse students and non-science majors. I am a first generation college student who found her path because of quality mentoring and undergraduate research experiences.

I am inspired by themes of inclusion, convergence, credentialing courses not degrees, imaging higher education as an on-and-off-ramp, by models that distribute the responsibility of education across all stakeholders, and alternative funding models that include internships, apprenticeships, and broad mentoring.

I wonder if this paradigm shift in undergraduate STEM Education will be easier to achieve at the small, 2- and 4-year institutions where being student-centered is a priority. Yet, to meet need, it must work at the larger public and private institutions that serve the many. I worry that many liberal arts institutions will close at a time when the values they espouse are in high demand and at a time when we are asking STEM education to incorporate more liberal learning. Will our large public institutions become our liberal arts

purveyors?

In all of this, I see potential identity crises: identity crises in institutions and identity crises in individuals.

This transformation of undergraduate STEM requires a paradigm shift akin to what Thomas Kuhn describes in his book, *The Structure of Scientific Revolutions*. He writes, “The decision to reject one paradigm is always simultaneously the decision to accept another, and the judgement leading to that decision involves the comparison of both paradigms with nature and with each other.”

Whatever we do, we shouldn’t lose sight of ...

...the importance of faculty and staff development, especially when asking those in higher education to create an experience they have never experienced before. We need to reimagine professional development.

I find myself struggling with how one creates professional development opportunities that would enable faculty and staff to experience and compare this new paradigm of education. Experiences lend concreteness and credibility to that which is new; they have the ability to transform the way people think and act.

This transformation, this paradigm shift requires...

— reimagined work and loads: What does it mean to teach? Do we measure work in course load or do we need a new measurement? What is the role of scholarship in the academy, remembering that our humanities and arts colleagues tend to work independently when advancing knowledge?

— reimagined reward structures: If mentoring, collaboration, learning communities, risk/entrepreneurship are valued more, what does that mean for our traditional structures? Tenure? Affiliation with more than one institution?

— a reimagined sense of self: The statement “I am a(chemist, engineer, etc.).” Is an important part of our identity. To achieve this identity, individuals experienced a training process that had certain hallmarks, hurdles, and badges of honor. It will be hard for individuals to imagine an educational approach toward development of a ... (chemist, engineer, etc.) that they can’t identify with. There will be feelings of loss, disappointment,

letting-down-of-peers, etc.

Wendi J. W. Williams
Faculty
South Texas College

A first thought on 13 November: In the future, a story we will tell about education is that it is now holistically seamless due to sustained efforts of diverse groups of change agents. No longer will we need to design rigid steps through grade progressions starting from the traditional kindergarten to whatever grade or age throughout a human lifespan. Gone will be explicit and ingrained implicit biases because we have evolved beyond personal judgement of others... because education and broadly defined family structures cultivated awareness about biases and how they manifest (for instance, lessons in pre-kindergarten all along the continuum for students, as well as faculty and staff facilitators. Age appropriate, but not a punctuated one time training. The interface between human capital (students, faculty, and staff) and intersectional resources to historically known content and unknowns “to achieve and know” (no longer like today’s silos of STEAM) are threaded between real in-person to virtual haptic experiences conveying information (visual, audio, touch, temperature, emotional) regardless of whether or not the lifelong student, faculty or staff has “some perceived socio-economic status,” or differs from year 2020 norms regarding sight, hearing, anatomy, mobility, or social acumen due to neuro diversity. Faculty and staff will intrinsically acknowledge and celebrate how inclusion moves humanity positively and productively forward.

Alessandra Zimmermann
Executive Director
Proposal Analytics

In 2040, I anticipate that the faculty and staff will have a very different role because Higher Ed is no longer looking to 'find the hidden gems' and instead looking to promote the development of the student's interests. Many people comment that gen Z has a 30 second attention span- and I think that's an unfair characterization of our students. They are so inundated with information and potential paths that they don't tolerate uninteresting topics as much as prior generations - and education is going to have to adapt to this abundance in possibilities to keep up. Students will want instruction not only in STEM, but the specific application of STEM that first attracted them. Therefore personalized teaching, mentorship and career development will have to rise up to keep these students engaged.