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1. Diverse students for diverse careers

We aim to attract and retain a wider range of students to engineering and prepare them for a broader variety of careers.

Currently, large departments like VT ECE successfully produce graduates who become specialists in big corporations. We are less successful at cultivating T-shaped professionals with critical thinking, interdisciplinary flexibility, and openness to difference.

increase “fan in”

Multi-pronged strategy for attracting students with a broader variety of backgrounds and life experiences .

increase “fan out”

- start-up / small company
- design firm
- non-governmental organization
- entertainment / new media / arts
- patent law
- management / consultancy / VC
- teaching / research
- government agency

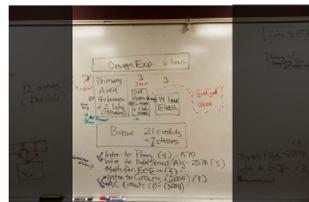
2. Design-based participatory change

In 2017-18, we focused on assembling several working groups of faculty, staff, and industrial advisory board members to brainstorm, design, and implement several aspects of the grant. Our participatory design process had notable successes:

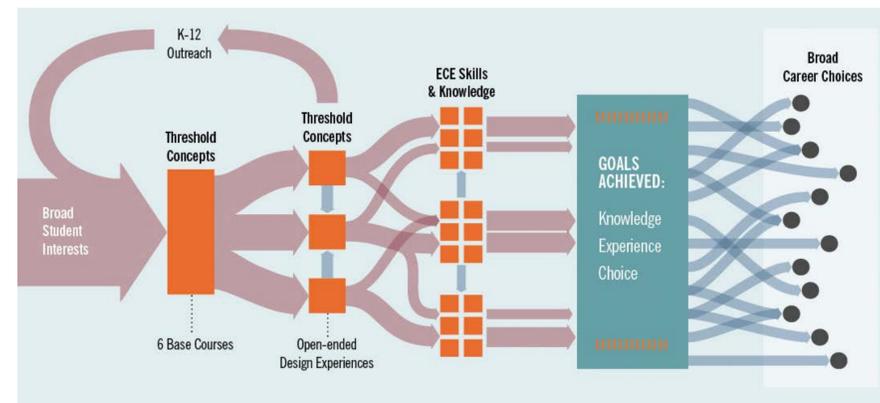
- **Our new overall program structure was approved by the faculty by a vote of 52-5 in Fall of 2017.**
- **All 20 faculty who were asked to participate in the base course design agreed.**

Some of the changes:

- New overall program structure: 7 “base” courses at the sophomore level
- Hands-on “real-world” projects that covers the breadth of the department



3. A student-success model that supports multiple design-based learning experiences



Curricular redesign: from two degrees to many pathways

- Create student choice by drastically reducing required courses
- First step: twelve new majors within ECE
- Toward a base of seven courses required of all students
- Integrate “real-world” modules throughout curriculum

New K-12 education and 21st century industry programs

- VT students & K-12 students to collaborate on class outreach projects
- Shift faculty perspectives by increasing their involvement in industry
- Expand experiential learning opportunities

Supportive departmental culture

- From a “rigor”-centered to a student success-centered culture
- Improve communication between faculty, advisors, and students
- Increase department emphasis on diversity and inclusion

Alum: “Are you making good ethical decisions? Are you understanding the limitations of your work? Are you acting like an engineer and not just building stuff.”

Advisor: “It’s a hard program. I feel like it’s harder on women.”

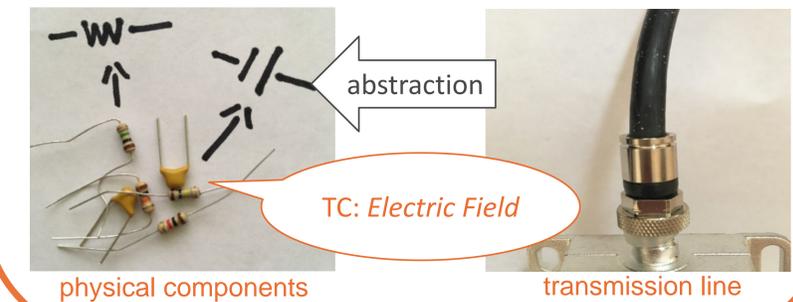
Student: “Professors tend to be here for research and they’re forced to teach a class.”

Professor: “Design and creativity . . . that’s very important.”

4. Threshold concepts as a framework for curriculum and identity

Threshold concepts are *transformative* for both cognition and identity, and *integrative* across disparate ideas in a discipline.

We use threshold concepts as transparent focal points in the curriculum redesign to reduce faculty “expert blind spots,” to inspire design-based modules, and to provide scaffolding for students to construct their own engineering identities.



5. Build sustainable change with collaborative partnerships

Second-year achievements

- ASEE panel session in ECE division with ISU and CSU
- ASEE WIP session led by U. of San Diego
- Working with Center for Excellence in Teaching and Learning to develop base courses, including participating in a project-based learning workshop at WPI
- Worked with a cross-university effort to secure a \$20M gift to the Honors College to support interdisciplinary undergraduate education, with ECE as one of five programs participating

