How to Manage a Revolution

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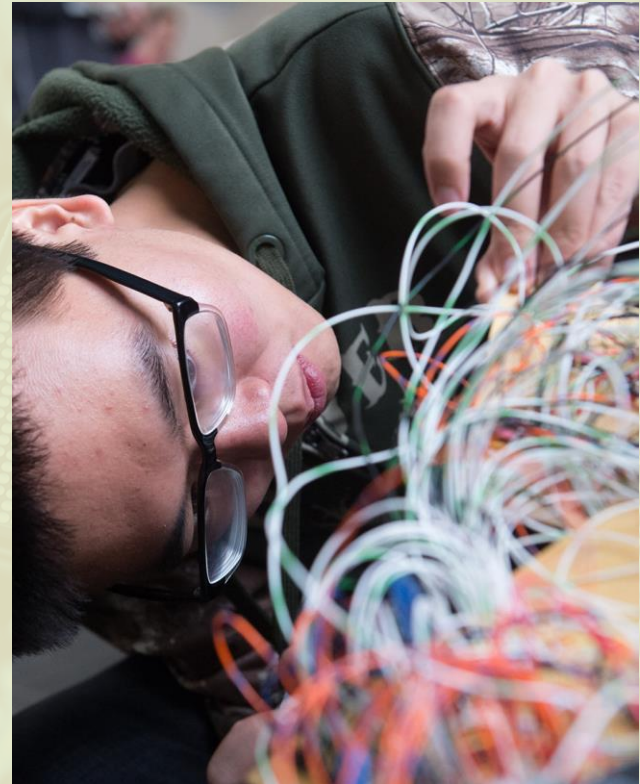
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Engineering Departments

Colorado State University
DEPARTMENT OF ELECTRICAL AND
COMPUTER ENGINEERING

Rethinking Courses in ECE

- Overview of new approach funded by NSF RED program

- How to rethink courses

- Forming a project team

- Securing buy-in

- Using questions to develop an implementation plan

- Conclusions

Holistic Approach Moves Away from Course-Centric Mindset
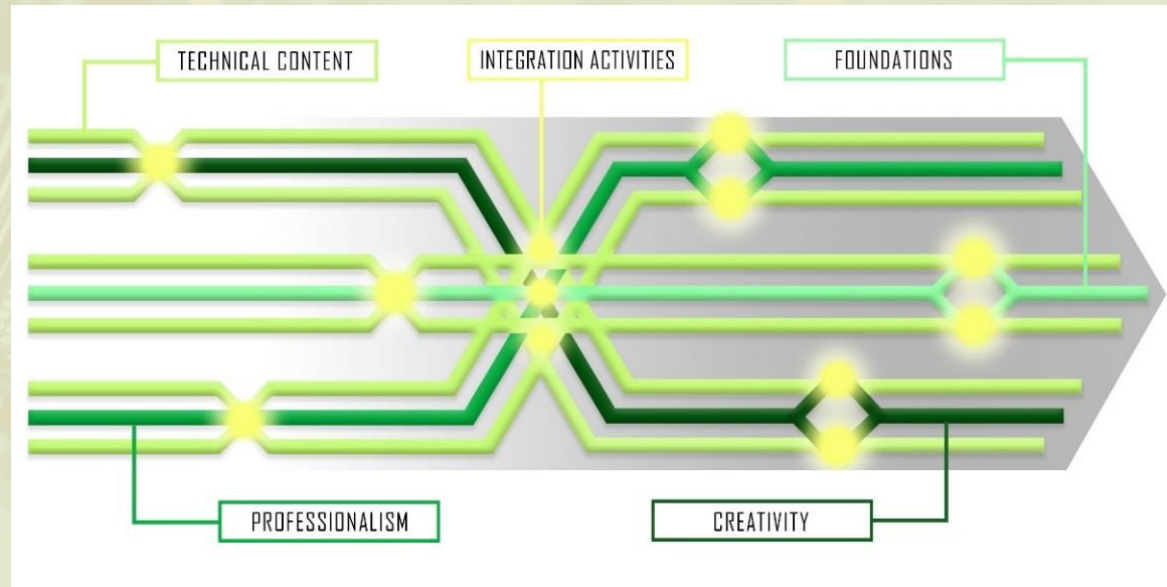
- Reimagined faculty roles

- Provides touchpoints for integrating knowledge

- Weaves threads throughout curriculum
  — Creativity
  — Foundations
  — Professionalism

Learning Studio Modules Blur Lines Between Courses

- In a given competency area, each LSM exposes one anchoring concept and a set of relevant subtopics

- Enables fine-grained assessments

	ECE 311 Linear Systems Analysis	ECE 331 Electronics Principles	ECE 341 Electromagnetics
Week 1	LSM 1	LSM 1	LSM 1
Week 2	LSM 1 Professional Formation	LSM 1	LSM 1
	Assessments, LSM 1 concepts		
Week 3	LSM 2	LSM 2 Foundations	LSM 2
Week 4	LSM 2	LSM 2	LSM 2 Creativity
	Assessments, LSM 2 concepts		
Week 5	Knowledge Integration Activities		

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Knowledge Integration to Understand Why

- KI activities illustrate fundamental concepts through tangible, hands-on exercises

- Students understand *why* they are learning material and how it will help them engineer a better world

Threading Knowledge Throughout the Curriculum

- **CREATIVITY**
research, design, innovation, and optimization

- **FOUNDATIONS**
math matters and here's why

- **PROFESSIONALISM**
skills that enable the technical know-how to be received and understood by others
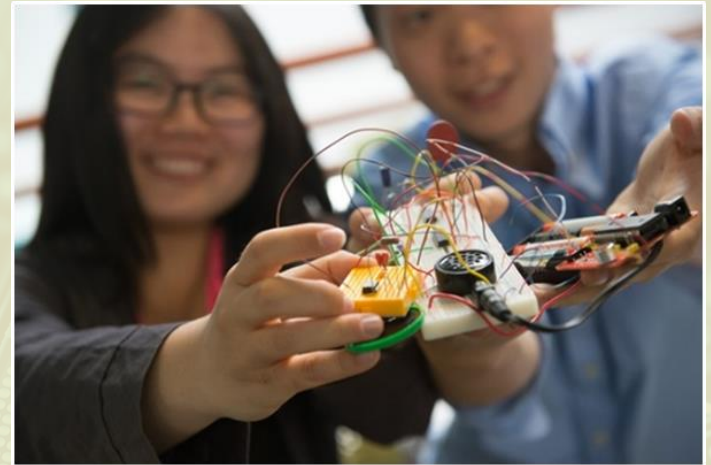
Leveraging Strengths to Form Project Team

KEY ROLES	REIMAGINED RESPONSIBILITIES
Project Lead/PI	Department head and visionary
Co-PI, Social Scientist	Organizational climate and change
Co-PI, Engineering Education	Pedagogical approach and educational research
Co-PI, Engineering Core	Visionary for curriculum redesign, KSIs, and LSMs
Project Manager	Logistics, direction, and execution of project
Communications Specialist	Communicates vision and accomplishments, internally and externally
Technical Core Content Experts	Determine fundamental technical concepts that define an electrical and computer engineer
Technical Core Team Members	Help define core content independent of courses
Integration Specialists	Synthesize content and identify touch points for knowledge integration
Math Foundations Champion	Leads partnership with Math to help students understand foundational content
Professional Formation Thread Champion	Works with industry to ensure graduates are better prepared for the profession
Creativity Thread Champion	Brings creativity, research, and design into all levels of the program

Securing Buy-In

- Promote interdependence and autonomy to encourage organizational culture for new ideas

- Communicate the vision and goals (regularly, consistently)

- Create incentives to overcome barriers in higher education
  - Promotion and tenure
  - New award criteria
  - Teaching support

# Using Questions to Develop the Implementation Plan

Logistics of Throwing Away the Course-Centric Mindset

- How can we shift the mindset given the course-centric nature of higher education, e.g., registration, grading, transcription, etc.?

- How can semester hours be reallocated to KIs and LSMs?

- Do courses need to be co-located and sequenced on the schedule to make delivery more effective?

Technical Content

- What does it mean to be an electrical or computer engineer?

- What are the fundamental concepts of an ECE education, independent of courses?

- What are the anchoring concepts?
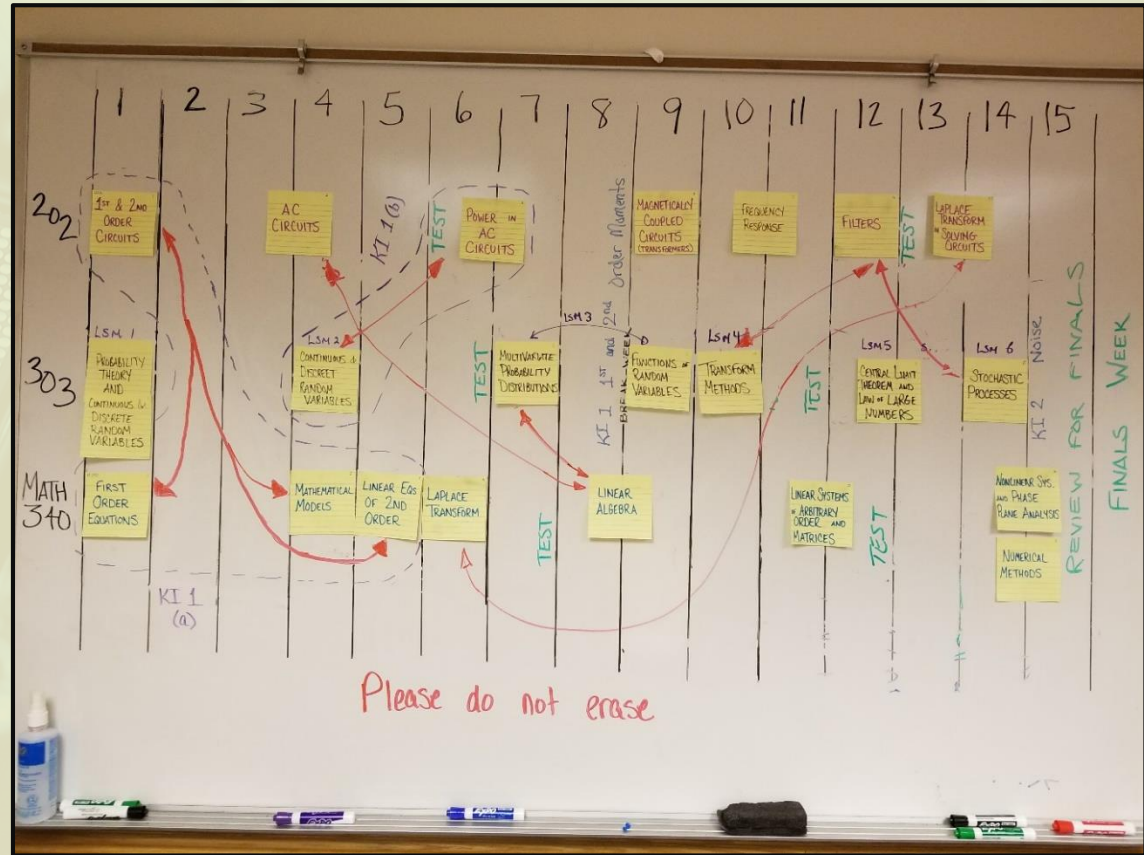
Threads

- **Creativity:** How do you best teach innovation, creativity, design, and optimization?

- **Foundations:** What is the value of a math perspective in engineering?

- **Professionalism:** What is state-of-the art in defining the critical skills engineers need to be effective in the profession?

Data Collection and Assessments

- How will we assess the effectiveness of both the cultural and pedagogical changes?

- What baseline data will be collected, and what methods will be used?

Communications

- Who are our audiences, both internally and externally?

- What are the key messages?
  - What do people need to understand/do in order for the project to succeed?

- What tactics will we use to reach our target audiences?

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Partnerships

- Who are our key partners?

- Who will be our internal champions, e.g., Dean, Provost, etc.?

- Who are our external advocates, e.g., advisory board, alumni, etc.?
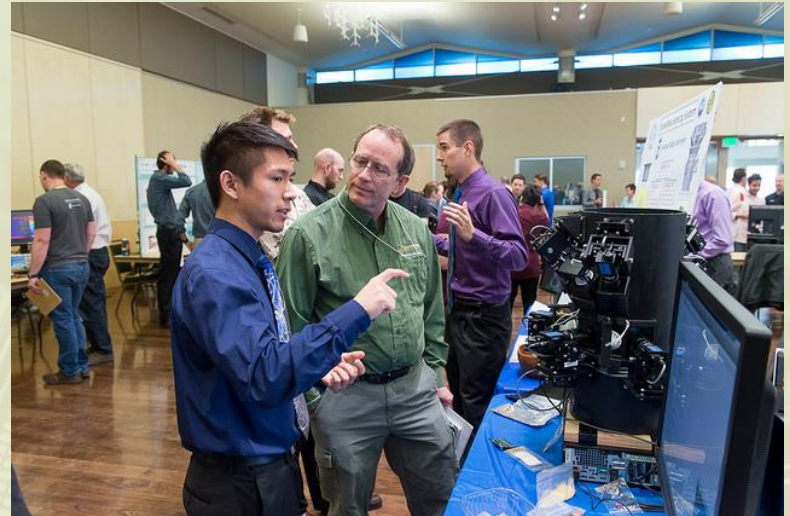
Conclusions

- Early results show that our project is making an impact

- Questions will be useful to others wishing to adopt our pedagogical innovations

- Project underscores the importance of universally defined technical concepts in ECE education

World Café:
Tips on Managing a Revolution

Project management & logistics	Melissa Reese
Technical content	Tom Chen
Thread content & partnerships	Tom Siller, Tony Maciejewski
Culture change efforts	Zinta Byrne
Educational data collection and assessment	Laura Sample McMeeking
Communications	Andrea Leland