Flipping the Curriculum

Dennis M. Freeman
Professor of Electrical Engineering
Dean for Undergraduate Education

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Adapting Higher Education for the 21st Century

Traditional bottom-up curricular structure.

Learn the fundamentals first
– EECS: programming, circuits, feedback, computer architecture

Build more advanced subjects on fundamentals.

Provide integrative electives and capstone.
Adapting Higher Education for the 21st Century

New technologies and areas interest → more fundamentals.

Not just programming, circuits, feedback, computer architecture.
Students want and need access to new “fundamentals”
– algorithms, inference, photonics, data science, ...

Problem: cannot add more subjects and remain a four-year program.
Adapting Higher Education for the 21st Century

A new type of structure is needed.

Allow choice.
Adapting Higher Education for the 21st Century

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Provide new type of introductory class to allow informed choice.
A new type of structure is needed.

Allow choice.

Provide **new type** of introductory class to allow **informed choice**.

**Early integration!**
Four modules to introduce areas of broad interest:

- Signals and Systems
- Circuits
- Probability
- Planning
Introduction to EECS I (6.01)

Four modules to introduce areas of broad interest:

- Signals and Systems
- Circuits
- Probability
- Planning

Focus on a small number of key concepts, each studied with depth, in an authentic context: a mobile robot.
Introduction to EECS I (6.01)

Most of the learning is in the lab.
Distinctive Features

- **On-Line Content Delivery**
  - self paced, instant feedback
  - frees class time for faculty/student interactions

- **Teamwork**
  - valuable skill + peer teaching can be very effective

- **Four Modules:** Signals/Systems, Circuits, Probability, Planning
  - broad but not superficial
  - interdisciplinary
  - solid introduction to EECS (and engineering more broadly)

- **Computer Programming** throughout
  - as an essential tool for engineers and scientists, and
  - to facilitate learning

- **Scalable Network of Teachers and Learners**
  - 10 faculty
  - 20 teaching assistants (mostly undergraduate)
  - 50 laboratory assistants (all undergraduates)
  - 500 students (approximately 6 students per staff member)
Enrollments

Nearly 40% of MIT undergraduates major in EECS.

Nearly 60% of MIT undergraduates take 6.01!
MIT undergraduate curriculum has bottom up structure.

All MIT undergraduates must take calculus, mechanics, electricity & magnetism, chemistry, and biology.

Departmental programs (e.g., EECS) build on those fundamentals. Bottom up, not integrated, no engineering, no computation.
New Efforts: Building on the Science Core

MIT undergraduate curriculum has bottom up structure.

Flip the curriculum. Add a hands-on, cross-disciplinary, task-based experience for first-year students.
Apply **principles of physics** to model sound.

Use those models to **design a loudspeaker**.

Build it using **laser cutting** and **3D printing**.

**Maker activities** to support learning in the **science core**
Flipping the Curriculum

Adding hands-on, cross-disciplinary, task-based experiences to the beginning of educational programs.

task-based introduction to MIT’s educational programs
deepen knowledge of calculus, physics, chemistry, biology
exposure to disciplines and majors → better informed choices
Questions for this Group

How can we implement this goal?

- Freshman Advising Seminar
- Freshman Learning Community
- Residence-Based Learning Community
- Other Ideas?