Problem Definition

The current undergraduate engineering education system fails in two critically important ways:
1) Students with the desire and aptitude to become productive engineers are not seeing the relevance of current curriculum and, consequently, they are abandoning the discipline. This is especially true for those entering the middle 2 years where an accelerated amount of new concepts are introduced.
2) Those who ultimately graduate from undergraduate engineering programs.

Facts

1) 42% of jobs will be in risk with the status quo STEM education (NEA)
2) Nationally, less than 50% of the students who enrolled in the students find it difficult to grasp the concepts because they are abstract and mathematically intense.
3) 30% of STEM students don’t graduate within 6 years
4) At Colorado State University, we typically lose about 40% of our engineering students in the first two years.

Previous Attempts to Change EE UG Education

1) University of Florida and Drexel’s EE program: first year course reforms.
2) IMPULSE at Massachusetts-Dartmouth, the Engage at Tennessee, and others, adopted separate courses that include more hands-on and project experiences to help students find it difficult to grasp the concepts from different LSMS to make learning more relevant.
3) Students do not see the connections between core competency courses and how they fit into the big picture, as well as why the mastery of individual topics matters greatly for solving real-world problems.

Core Competencies & Anchoring Concepts

Electronics
- Algebra
- Analytic geometry
- Trigonometry
- Basic calculus

Circuits & Systems
- Circuit analysis
- Signal processing
- Control systems
- Power systems

Electromagnetics
- Wave propagation
- Antenna theory
- Microwave circuits
- Transmission lines

Mathematics
- Linear algebra
- Multivariable calculus
- Probability

Our Approach

Our Approach

1) Traditional courses are broken down into self-contained learning studio modules (LSMs)
2) Each LSM covers an anchoring concept
3) Knowledge integration (KI) modules across different core competency areas weave together anchoring concepts from different LSMS to make learning more relevant.

Implementation

Implementation

1) Holistic view of core competencies and how they are related using a matrix-based curriculum.
2) Threads to weave foundational concepts and creativity.

Conclusion

A new pedagogical approach to address the attrition trend in undergraduate EE engineering program is presented. This approach provides both the longitudinal and latitudinal integrations to significantly alter the existing learning model by systematically infusing applications of the anchoring concepts in these core competency areas. This will enable students to gain knowledge to become productive engineers.