Chantilly Academy (High School)

Engineering Math

National Engineering Mathematics Consortium

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Overview

- Chantilly Academy: Who we are
- High School vs. College
- Year 1 – How it went
- Year 2 – The Plan

What is Chantilly Academy ?

- Largest of 6 Career & Technical Education part-day Academies in Fairfax County Public Schools
- 1,200 students (10^{th} – 12^{th} grade) from Chantilly High School and 19 other Fairfax County high schools
- 26 Career & Technical Education program areas including a 3 course sequence in Engineering (133 students)
  - Engineering Systems 1 – Building (Inventor, Master CAM)
  - Engineering Physics - Math and Physics (MATLAB)
  - Engineering Systems 2 – Complex systems (Lab View)

Why Engineering Math in High School ?

- Motivational: Students apply math knowledge
- Informational: Students experience EE & ME
- Builds on existing pre-engineering courses

- Different than collegiate goals of:
  - Prepare student to take statics or circuits next semester
  - Increase retention

High School vs. College

- Timeline: 36 weeks vs. 10 weeks (WSU)
- Proficiency: Motivational vs. Core prerequisite
- High School Math Elective: Classwork vs. Homework
- Varied Backgrounds of Students (*not high school unique?*)
  - Algebra 2 Prereq, Precalc Coreq
  - 15 Total Students: 4 in Precalc, 11 in AP Calc

Year 1 - Overview

- Followed WSU curriculum fairly closely
  - Skipped some later derivative examples
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  - Added Laplace transform as Diff Eq solving technique
- Outline notes
- Completed most labs
  - Added a vector lab
  - Modified sinusoid circuit lab and free fall derivative
  - Lost some lab momentum at end (Differential Equations)
- Decent MATLAB integration

Year 1 - Positives

- Students really liked coming to class
- Pre-Calc students were seriously impressed with where all this was going
- Calc (and Pre-Calc) students enjoyed the new stuff
  - Circuits: labs and theory
  - Differential Equations
  - ME applications

Year 1 - Challenges

By far, the biggest challenge was varied math backgrounds

- **Calc kids bored in derivative / integral section**
  - **Having them work ahead independently didn't work**
  - **Having them partner with non-AP kids didn't work**
- **By Differential Eqs, I was teaching two classes**
  - **1st 10 to 15 minutes: Fast paced instruction for Calc kids**
    - **They go to independent MATLAB or problem solving**
  - **Rest of class: More deliberate instruction to Pre-Calc kids**

Year 2 – The Plan

- 19 students registered
- Pair Calc with Pre-Calc (early and rotate)
- Move Calc students faster and deeper
  - Labs: build in extensions and off ramps
  - Problem sets: have Calc Students set up problems
- Quizzes: Common portion + extension for Calc students
- Labs: Tailor to our facilities
- Add some Control System theory?

Summary

- Overall, I was pleased with year 1
- Covered most of the WSU curriculum
- Room for improvement:
  - Differentiation: earlier, faster, deeper, longer
  - MATLAB: More involved code
  - Labs: Tailor to our facilities / equipment
- Kids liked it. Grade comparison TBD