Lessons Learned from Renovation of NJIT’s Chemical Engineering Curriculum through an Infusion of Computation and Multiphysics Modeling

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NJIT/CHE DEPT. BACKGROUND

• Severely outdated ChE curriculum
• NJ Law: BS ≤ 120 hrs
• Orphaned Course: “Tech Process Simulations” (Aspen)
• Freshman CS (Matlab)

PROBLEMS/CHALLENGES:
- Writing Code From Scratch
- Pre-made Subs (book/profs) / Follow-Along
- Confused by Two Simultaneous Topics
- Cheating is Too Easy
- Randomized Problems
- Individualized Problems
- Coding on Tests Skills (Grading, Cheating)
- Time Management
- Prefer Free Languages (Python & VBA)
- Prefer Simulation Soft.: COMSOL / ASPEN

LESSONS/SOLUTIONS/COMPLICATIONS:
- Freshman MATLAB course → C++
- Lecture → Lab (“Active Learning”)
- Math @ Home / Code in Class
- NetOP Software (online HDs, lack of PCs)
- MGH-CONNECT (buggy, $)
- Groups w/ Dedicated TAs
- No Coding on Tests!
- TAs Grades HKWs in Lab, iClickers
- Maybe After Tenure
- COMSOL Tutorials Project

NUMERICAL METHODS & MODELING

First U.S. ChE Curricula Survey in 60 years

Numerical Methods & Modeling
Statics & Strength of Materials
Che course credits plotted as % of total degree credits

- 114 (77%) of the U.S. depts. → warranted!
- Avg. Credits: 3.4 (2.6 across all depts.)

Tool for guiding / justifying changes:

Undergraduate Heat & Mass:
- Discretize Numerically → Solve by Hand
- Give Solution & Re-solve via All:
  Excel, MATLAB, Mathematica, & COMSOL
Graduate Transport Phenomena:
✓ Problems from Work
✓ Research by Professors
→ Report = Mini Scientific Paper:
  Literature review, methods, results, conclusions

LESSONS LEARNED:
- Convenient Tutorials
- Variable Difficulty
- Difficult to Grade
- Course Evaluations

COMPUTATION IN CHEMICAL ENGINEERING CURRICULUM

INFUSION IN OTHER COURSES

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