A Comprehensive Curriculum Revision of the Sophomore Year

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Overview

Problems:

- lack of motivation for fundamentals
- poor retention of lower level concepts
- segmented learning
- inability to extrapolate out of context
- poor communication and teamwork skills

Goals:

- improve problem solving abilities
- improve mastery of fundamentals
- improve teamwork skills
- improve attitudes and satisfaction with chemical engineering
Structure of Curriculum

- Team design projects - some open-ended
- Individual homework and exams

Instructional approaches
- based on educational research literature
- active in-class learning
- address diverse learning styles with multiple instructional techniques
- reinforcement of key concepts with increasing complexity
Traditional Sophomore Course Sequence

Course 1: Material and Energy Balances
Course 2: Classical Thermo
Course 3: Mixture Thermo
Course 4: Separation Processes

New Curriculum
Simple  Complex
Implementation

Year 1: curriculum development; assessment design

Years 2 and 3: Implementation

- **Control group**: students taught in the traditional course sequence and fashion (Control=Old Curriculum)

- **Test group**: students taught in the “spiral” curriculum (Spiral-Taught=New Curriculum)
Project Evaluation Philosophy

- Multiple metrics focused on goals
- Formative and summative measures
- Qualitative and quantitative assessment tools
- Use of test and comparison student groups
- Use of external evaluators
### Assessment Tools

**Qualitative**
- Interviews
- *open-ended* questionnaire
- Videotaping: key performances
- Audiotaping: class and project work

**Quantitative**
- Pre/post surveys
- WPI course eval.
- Exams and reports
- *Team problem solving* competition
- Individual comprehensive exam
The spiral-taught student cohort:

- Performed better in the team problem solving competition
- Performed the same or better, as individuals, on the year-end exam
- Received higher grades in follow-on junior and senior level chemical engineering courses
Results Summary...

The spiral-taught student cohort:

- Expressed more positive attitudes about chemical engineering and higher confidence in the major
- Had higher retention rates in the major
- Won a greater percentage of academic awards
Summary

- New curriculum required for all second-year chemical engineering students
- Funding from Dept. of Education, FIPSE

Publication references:

*Chemical Engineering Education*

- “A Project-Based Spiral Curriculum for Introductory Courses in Chemical Engineering: I, II, III”
- in volumes 34 and 35 (2000 and 2001)
Continuing Development

- Inclusion of new concepts and technologies
- Retention issues
- New learning issues
- Complete curriculum review