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

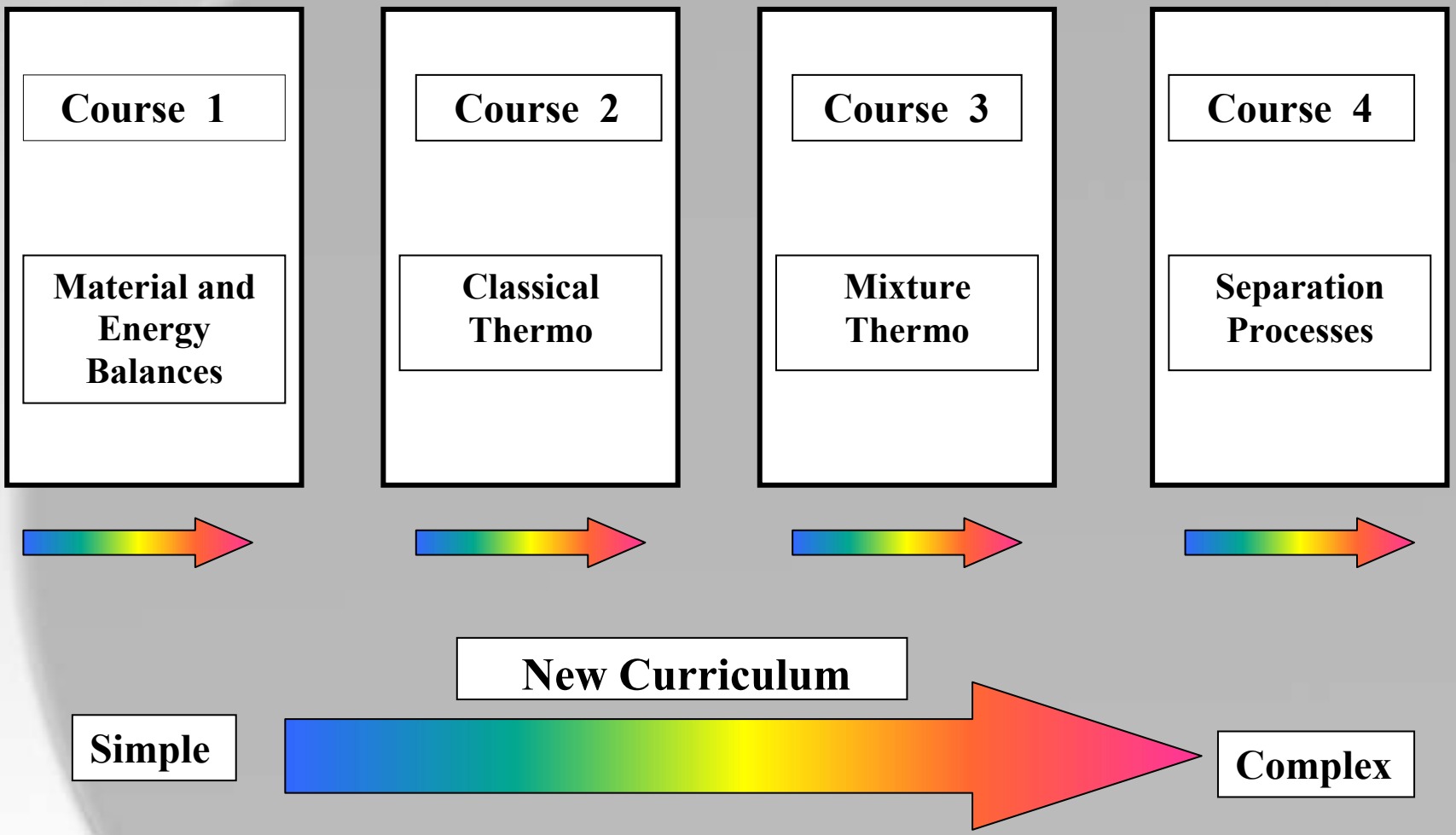
Goals:

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

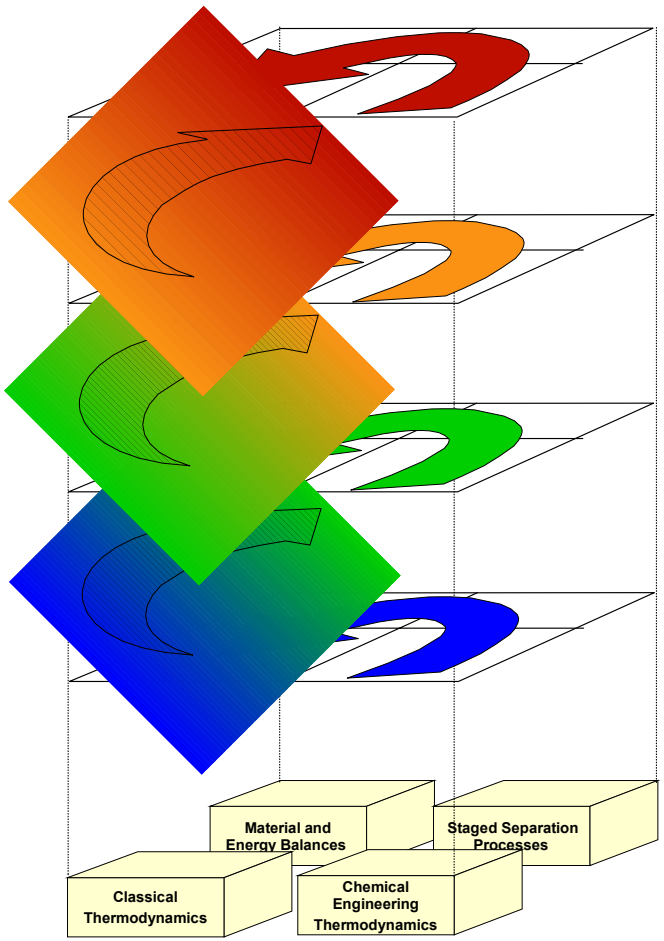
Structure of Curriculum

- 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



SCHEMATIC DRAWING OF THE SPIRAL CURRICULUM



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***

Results Summary

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