Communication and Project Management for Multidisciplinary Teams

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Drs. Paula Berardinelli, Saundra Williams - Adult and Community Education
Drs. Lisa Bullard and Steven Peretti - Chemical Engineering
Dr. Robert Fornaro, Ms. Margaret R. Heil - Computer Science

NC State University
Overview

- Setting
- Instructional Model
- Preliminary Project
- Results
- Current Project Objectives
- Pilot Semester - Spring 2001
- Recent Developments

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Multidisciplinary Senior Design

- 15-Week Capstone Project
- Realistic Experience
- Active Industrial Mentorship
  - International Society of Pharmaceutical Engineering Members (ISPE)
Multidisciplinary Course Management

- Issues
  - Uncertainty About Purpose
  - Confusion About Language
  - Disciplinary Disconnect

- Common Course Superstructure
  - Calendars/Syllabi Coordinated
  - Team Training
  - Parallel Development Processes
Instructional Model

Student Performance as Measured by Quality of Output

Process

Technical Communication

Teaming

Teaming

Teaming

Teaming
Teaming Elements

- Individual Strengths Optimized
- Performing
  - Decision Making Tools/
    - Design Techniques
  - Agendas
    - Project Task Plan
- Norming
  - Ground Rules/Team Roles
    - Colors Workshop
- Storming
- Forming
Multidisciplinary Team Communication

Various Audiences

- Fellow Students
  - Own Discipline
  - Another Discipline
- Faculty & Mentors: Many Disciplines
- Scientifically Literate
Technical Communication Skills

- Formal Reviews
  - Oral Technical Presentations
  - Written Documentation
- Interpersonal Communication
  - Disciplinary Language
  - Disciplinary Problem Solving Approaches
Multidisciplinary Design Project

- Produce Significant Quantities of Citric Acid
- Manufacturing Execution System
Ingold 4300
DO Transmitter

Control Panel & Service Module

Fermentor
Fermentation Media & Fungus

Utilities
air, steam, water
110, 220 Volts

Filter
Student Initiated Revised Development Paradigm

- Realized Deadlines Unreachable
- Iterative Design
- Feedback Loop – Outside “Comfort Zone”
Alpha Release

Data Retrieval
Process Assistance
Load/Save Process
Database
GUI

Report Generation
Data Collection
### Beta Release

<table>
<thead>
<tr>
<th>Enhanced Security</th>
<th>Remote Access</th>
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<tr>
<td>Data Retrieval</td>
<td>FDA Reports</td>
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<td>Database</td>
<td>GUI</td>
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1/31/02
## Final Release

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<tr>
<th>Help Documentation</th>
<th>Improved GUI</th>
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1/31/02
Final Phase Goals

Chemical Engineers
- Complete Validation
- Final Equipment Calibration
- Perform Initial Fermentation Run
- Refine Fermentor SOPs
- Incorporate Electronic Data Collection

Computer Scientists
- Refine GUI
- Expand Database
- Benchmark Usability Tasks

NC State University
Conclusions from Initial Implementation

- Positive Results
  - Emphasis on Teaming, Writing & Speaking
  - Multidisciplinary Development Methodology

- Future Directions
  - NSF Action Agenda
National Science Foundation
Grant No. EEC-0080484

Creating Multidisciplinary Curricular Paradigms: Bioprocessing & Chemical Engineering

NC State University
Project Goals & Objectives

- Transition to Workplace Environment
  - Multidisciplinary Design Experience
  - Integrate Teaming, Writing, Speaking (TWS)
  - Incorporate TWS Concepts into CHE Bioprocessing Option
- Disseminate Model & Information
Spring 2001
Multidisciplinary Design Projects

1. Fermentation Manufacturing Execution System (CHE, CSC)
2. Transgenic Protein Purification (CHE, FS)
3. Conceptual Engineering Design for Retrofit of an Existing Biological Facility to Produce Antigenic Co-Proteins (CHE, IE, ECON)
4. Supervisory Control System for Research Fermentation (CHE, CSC)
Spring 2001
TWS Module

- Team Training
  - Stages & Roles
  - Meetings: Minutes & Agendas
  - Individual Accountability: Logs & Peer Evaluations

- Writing & Speaking
  - Phased Documents & Presentations
  - Feedback
  - Collaborative Revision & Practice

- Student Reflections

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Spring 2001 Assessment

- Pre- & Post-Course Questionnaires: Student Attitudes & Experiences
- Focus Groups
- Course Evaluations
- Comparison of Student Portfolios: Documents & Presentations

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Evaluation - Written and Oral

- Technical Content (60%)
- Organization (15%)
- Presentation (15%)
- Layout/Visuels (10%)
- Evaluated by faculty and industrial mentors

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Student Performance

- Consistent improvement in writing performance
- Oral presentations deemed “superior to every group not receiving TWS instruction” in CHE
- 4 of 5 final oral reports scored at A level
- All written reports scored at A level
Student Reflections

- Feelings of Uncertainty
  - How can THEY understand US?

- The Teams Meet
  - “You are our sponsors, right?”
  - “We don’t have anything for you yet.”
  - “What do you want?”
  - “What can you give us?”

- Misunderstanding the Project
  - Just what are the project descriptions saying?

- Pre-conceived ideas
  - We’ll do it our own way
Student Conclusions

Open communication is key
Continuous feedback is essential
Terminology synchronization
Be opened-minded & flexible
Keep working toward the goal
Multidiscipline teamwork can bring great success!
Spring 2001
Lessons Learned: Faculty Team

- Communication/Coordination
- Faculty Role Definition
- Resource Intensive
Spring 2001
Lessons Learned: Implementation

- Common Meeting Times
- Guided “outside the box”
- Need for Teaming/Writing/Speaking Integration

NC State University
Recent Developments

- Integrated TWS Module
- TWS Introduced into Junior Lab Course
- Project Web Site
  http://www.che.ncsu.edu/action_agenda/
<table>
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<tr>
<th>Course</th>
<th>Spring 2001</th>
<th>Fall 2001</th>
<th>Spring 2002</th>
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Why Are You Here?

Chemical Engineering
National Science Foundation Grant

I (or my research team) would like to learn about the NSF project, either because it might inform my research or because I’m interested in proposing or exploring a similar project at my own institution.

Continues With Summaries & Associated Links

NC State University
Learn About the NSF Project

Chemical Engineering
National Science Foundation Grant

About the NSF Project

- Project Proposal
- NSF Team Plan
- Team Meetings
- Team Process

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Revise a Course

- **Design Course**
  - Learning Goals
  - PowerPoint Modules
  - Syllabi
  - Reflection Assignments
  - Annotated Papers
  - Sample Presentations

- **Lab Course**
  - Learning Goals
  - PowerPoint Modules
  - Syllabi
  - Reflection Assignments
  - Annotated Papers
  - Sample Presentations
Revise A Curriculum

- Learning Goals for Courses
  - Chemical Engineering
  - Food Science
  - Computer Science
- Faculty Training & Support Materials
- Protocol for Cumulative Instruction Between Courses
  - Within Chemical Engineering
  - Between Chemical Engineering & Other Disciplines
Conclusion

- Development of Instructional Materials
- Initiation into Junior Courses
- Integrated TWS Teaching Module
- Assessment tools
- Publications & Conferences