What is the Vision?

• We asked two simple questions
  
  o Who are we educating?
  o What are we preparing our students for?
    o What are the essential skills we want to equip our students?

• Vision
  
  o Future engineers/ problem solvers, who can creatively, independently learn, think, and apply knowledge.
How to train someone to independently learn and More importantly be creative and think?

- Answer is always hidden in the question?
  - Independent thinking, problem solving and knowledge application can be best taught in real life situations/projects.
  - Creativity can be nurtured by freedom to make decisions, without pressure of failing.

Implementation – Key Challenge

• Bringing changes are not typically easy!
  o If we consider taking into account all the requirements prescribed on us, we are left with very little actual time for hands on learning based projects.

• We are left with limited contact time
  o First year – 29 hours
  o Second year – 48 hours
  o Third year – 60 hours

• Creative solution was essential
A Journey into Discovery

Students as Partners

- Projects were designed and tested by students for students
- Student views were included in
  - Equipment design
  - Course materials
  - Beta testing

Foundation Lab

Sample Project: The Pump Specification Problem (8 projects)

Learning Objectives:

▪ Express pressure in terms of head
▪ Apply Bernoulli’s equation for incompressible fluids to calculate pressure drop through different fittings
▪ Perform hydraulic pressure drop calculations and NPSH checks on a pump
Knowledge Lab

Sample Project: The Continuous Water Purification Problem (14 projects)

Learning Objectives:
- Develop understanding of breakthrough curves and apply it to determine packed bed dimensions
- Use control tuning rules to establish independent loop control
- Understand interactions within control loops and implement plant wide control
Discovery Lab

Sample Project: Protein Chromatography (14 projects)

Learning Objectives:
• Develop experimental chromatography protocols to quantify protein aggregation
• Investigate accelerated protein aggregation using SEC or another experimental technique
• Determine B22 values using SIC for model and therapeutic proteins
ZPD in Action

How the Journey Unfolds

Research Project (4th Year)

Discovery Lab (3rd Year)

Knowledge Lab (2nd Year)

Foundation Lab (1st Year)

Independence & Complexity

Instruction, training & support

Instructor/ Teacher

Facilitator/ Supervisor

Teacher/ Facilitator

Supervisor/ Collaborator

Student Evaluation

The Discovery Lab structure gives me freedom to make key decisions about my project.

I had to take charge of my own learning to achieve the learning outcomes.

The module structure motivated me to take calculated risks.

Resource constraints pushed me to develop unconventional solutions.

Considering the complexity and constraints, team members had to work independently of each other.

My team members supported each other to overcome failures.

Peer assessment helped me to better understand my strengths and weaknesses.

Adequate support was provided during the project.

The interaction with academics at regular intervals boosted my confidence in my decision making skills.
Evaluation - Enabling Environment

The assessment structure provided appropriate rewards for thinking outside the box.

The module required me to evaluate results, reflect on the findings, and make decisions on work direction.

The module taught me how to learn from failures.

The authenticity of the equipment helped me to understand typical challenges faced by researchers.

As a result of this experience, I feel more competent to conduct research / manage my own work.

The Discovery Lab project motivated me to conduct research in future.
Internal Environment

Internal Environment

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Student Voice

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