BEST PRACTICES: PROJECT-ORIENTED PROBLEM BASED LEARNING

Integrated Design Project (IDP)
About the Speaker

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- PhD (Agricultural Engineering)- Iowa State University
- 3 years teaching Agricultural and Biosystems Engineering Integrated Design Project (EAB4947)
Learning Objectives

- Understand the main practices of POPBL in IDP class
- Receive and give constructive feedbacks on the POPBL practices -- Learn from each other 😊

CO-PO Mapping

Assessment Rubrics

“A great teacher is someone who can learn from their students, who can learn with them, and learns for them.”

— Robert John Meehan
Problem BL vs. Project BL

POPBL: Integrated Design Project

**Problem-Based Learning**
- Groups
- Students define the problem
- Students identify action steps
- Create a solution
- Metacognition

**Project-Based Learning**
- Individual or group
- Teacher defines the problem
- Teacher identifies action steps
- Create a product

**Both**
- Teacher as guide
- Students at centre
- Real-world connections
- Active learning
- Self and peer assessment

**Bottom Line:** In Problem-Based Learning, students have more control over their own learning and the processes involved.
What is POPBL?

A systematic teaching method that engages students in learning knowledge and skills through an extended inquiry process structured around complex, authentic questions and carefully designed tasks over a period of time, resulting in a product, presentation or performance. Typically has timeline and milestone, and other aspects of formative evaluation as the project proceeds.
Why POPBL for IDP?

- **Student Centered Learning**
  - In collaborative and interdisciplinary environment that motivates high level thinking

- **Skills and abilities development**
  - Problem solving
  - Communication
  - Cooperation
  - Negotiation
  - Decision making
  - Life-long learning
## What is our end-game?

### Engineering Design

<table>
<thead>
<tr>
<th>CO1</th>
<th>Design projects related to agricultural and biosystems engineering (C6, CTPS)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>ENGINEERING DESIGN (CONCEPT, CRITERIA, APPROACHES)</strong>!</td>
</tr>
<tr>
<td>CO2</td>
<td>Integrate software and hardware with an appropriate method for agricultural</td>
</tr>
<tr>
<td></td>
<td>and Biosystems engineering project (C6, ZS, TS)</td>
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<tr>
<td></td>
<td><strong>ENGINEERING DESIGN ANALYSIS</strong></td>
</tr>
<tr>
<td>CO3</td>
<td>Organize the execution of the project includes planning, monitoring, financial</td>
</tr>
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<td></td>
<td>and human resources (A4, EM, KK)</td>
</tr>
<tr>
<td></td>
<td><strong>ENGINEERING PROJECT MANAGEMENT</strong></td>
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## What’s in it for Eng. students?

### Design Approaches

<table>
<thead>
<tr>
<th></th>
<th>Mechanical</th>
<th>Electrical</th>
<th>Chemical/Biological</th>
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</thead>
<tbody>
<tr>
<td><strong>Design Concept</strong></td>
<td>Mechanically</td>
<td>Electronically</td>
<td>Chemically/Biologically</td>
</tr>
<tr>
<td><strong>Design Criteria</strong></td>
<td>Materials, Aesthetics, Geometry, Physical Features, Cost, Reliability, Usability, Use environment</td>
<td></td>
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<tr>
<td><strong>Design Analysis</strong></td>
<td>FBD, Strength, Force &amp; Pressure analysis, Materials</td>
<td>Circuit analysis, Power analysis, Performance analysis</td>
<td>Mass, energy-balanced, thermal analysis</td>
</tr>
<tr>
<td><strong>Output/End Product</strong></td>
<td>Simulation, Prototype Development</td>
<td>Simulation, Prototype Development</td>
<td>Procedures, Simulation, Prototype Development</td>
</tr>
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### Engineering Design Process

- **ASK** to identify the need and constraints
- **RESEARCH** the problem
- **IMPROVE** and evaluate the prototype
- **TEST** and evaluate the prototype
- **CREATE** a prototype
- **PLAN** by selecting a prototyping solution

[Diagram of the Engineering Design Process]

[TeachEngineering.org]
Understanding Teacher’s Role

- Lecturer/Instructor?
- Facilitator? Yes
- Coach? Yes
- Sage?

Teaching vs. facilitating

One directional dissemination of knowledge through a teacher
Accompanying and shaping a learning process together
Designing IDP: POPBL Framework

Source: Ahmad Fauzi et al., 2018
Agricultural and Biosystems Engineering Design Project (EAB4947) SEM 1 2020/2021

<table>
<thead>
<tr>
<th>Kumpulan</th>
<th>Tajuk Projek</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ananas Sucker Picker</td>
</tr>
<tr>
<td>2</td>
<td>Fixed Distance Pineapple Planter</td>
</tr>
<tr>
<td>3</td>
<td>Auto Fertiliser Mixer for Fertigation And Hydroponic System.</td>
</tr>
<tr>
<td>4</td>
<td>Portable Poultry Auto Feeder</td>
</tr>
<tr>
<td>5</td>
<td>Oil Palm Loose Fruits Collector</td>
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<tr>
<td>6</td>
<td>Rice Hill Seeding Mechanism</td>
</tr>
<tr>
<td>7</td>
<td>Vertical Farming of Azolla Pinnata</td>
</tr>
<tr>
<td>8</td>
<td>Iot Based Monitoring System For Empurau Fish Farming</td>
</tr>
<tr>
<td>9</td>
<td>An Automated Sensing System for Methane Gas Release in Bio-Booster Production</td>
</tr>
<tr>
<td>10</td>
<td>Development of Lemon Grass Transplanter for Smallscale Farmers</td>
</tr>
<tr>
<td>11</td>
<td>Automated Irrigation System for Seed Germination</td>
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Planning for Implementation

IDP (EAB4947) 2020/2021

- Introduction to the course
- Group formation

WEEK 1
23/10/2020

WEEK 2
30/10/2020
- Project titles
- Appointment of supervisors and evaluators

WEEK 3
07/01/2020
- Continuous assessment of project progress by supervisors

WEEK 4
12/11/2020
- Project proposal presentation

WEEK 5
16/11/2020
- Submission of written project proposal

WEEK 6
03/12/2020
- Continuous assessment of project progress by supervisors

WEEK 7
16/01/2021
- Final Presentation
- Peer-to-peer evaluation by team members
- Deadline evaluation marks by SV and evaluators

WEEK 8
10/12/2020
- Peer-to-peer evaluation by team members
Rethinking Assessment

- Assessment for Learning (Formative)
- Assessment as Learning (Learning approaches)
- Assessment of Learning (Summative)

Gaging-- to help student learning, to improve teaching approaches

Project proposal, Proposal presentation, Peer-to-peer evaluation, Logbook/Project Management App/Portfolio

Final report, Final Presentation, Demo video
Project Proposal and Report

- Clear instruction!
- Provide outline – eg: ASABE manuscript template
- Emphasis the content that we are looking for:
  - CLEAR PROBLEM STATEMENT AND OBJECTIVES
  - ENGINEERING DESIGN (CONCEPT, CRITERIA, APPROACHES)
  - ENGINEERING DESIGN ANALYSIS!
Presentation Guidelines

10 MINUTES (10-12 SLIDES ONLY)
Presentation will be done on Zoom platform. Each group will be given 10-12 minutes presentation, and 3-5 minutes Q&A.

CONTENT SHOULD CONSIST ALL PROPOSAL OUTLINE
Follow the content that is outlined in your written proposal. Show your understanding and focus on the key points that the evaluators need (refer to evaluator rubrics). Be creative in presenting your idea. Use fun and free templates like using CANVA App. Bottom line is, avoid glaring mistake like grammatical and spelling errors! Have your supervisor to review your slides.

ORGANISATION AND PRESENTATION
Practise what do you want to say and how your team is going to present the proposal. Make sure it is within 10-12 minutes given time. Avoid using too many texts, use infographic instead. Keep it simple. Be prepared!
Project Management App

- Trello
- Teamwork
- ASANA
- Notion.so
Demo Video

- Example: Portable Poultry Auto Feeder
Online Evaluation and Assessment

- Proposal presentation – internal evaluators
- Written proposal – supervisors
- Project Management – supervisors
- Peer-to-peer evaluation – classmates
- Demo Video – class facilitator
- Final Presentation – internal and external evaluators
- Project Report – supervisors
Class of 2020 Virtual Design Day

11 Projects solving real world problem in ABE
11 supervisors
2 Lecturers and 4 professional engineers as evaluators
Way Forward

- IDP webpage
- *Yearly Integrated Design Projects Compilation Book* – Penerbit UPM
- Project sponsorship
- Any suggestion?
Hoffman, Harvey F.
The Engineering Capstone Course
Fundamentals for Students and Instructors
Springer (2014)