Integrated (across class topic & level) Project Based Learning

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Introduction and Objectives:

Increase use of Project Based Learning (PBL) while integrating topics across the Industrial & Manufacturing Engineering (IME) curriculum and class levels.

1. Prepare students for project work they will experience in industry
2. Develop students content knowledge by integrating curriculum in project execution
3. Develop students networks across class levels

This opportunity can be expanded beyond a single department and progress to across departments within a college and ultimately colleges across a university.

The initial class listing within IME can be a variety of combinations (upper/lower class); Facilities Planning/Process Improvement Fundamentals; Quality/Design of Experiments; Advanced Human Factors/Intro to Human Factors; Senior Project/Introduction to IME; etc…

Developmental History of Innovation

This was piloted in the Winter quarter of 2012 with Facilities Planning (senior), Simulation (senior), & Process Improvement Fundamentals (sophomore) classes. Facilities Planning and Process Improvement Fundamentals classes had teamed up before but in a very loose manner, student driven vs instructionally planned.

"Froyd and Ohland[1] found that the integration across the curriculum for freshman students increase retention and engagement for students and enhanced faculty development. Integration of older students with younger students has also contributed to retention and persistence[2]."[3]

1. Froyd, J. E. and Ohland, M.W. Integrated Engineering Curricula. Journal of Engineering Educaiton, Jan 2005. P 147-164.
2. Beterfield-Sacre M. Atman, C.J. Shuman, L.J. Engineering Students Attitude assessment Journal of Engineering Education April 1998 p 133-141.
3. Schlemer , Alptekin, Bangs. Proceedings of the 2012 ASEE PSW Section Conference, "Integrating Courses Through Project Based Learning"

Learning Activities and Materials

- Develop skillset to effectively teach in a 'true' project based learning mode
- Checklist and "How to Guide" for project selection and most applicable courses to engage
- Participation contracts (set expectations):
  - Company/project sponsor
  - Faculty
  - Students*
- Develop methods to effectively identify and manage teamwork in a timely manner (for faculty & students)
- Convert classes to 'flipped' teaching model (see example below from pilot)
- Link course schedules (see example below from pilot)
- Tools/processes to recruit faculty to participate

* The upper class students have the additional responsibility of coaching & managing the lower class students
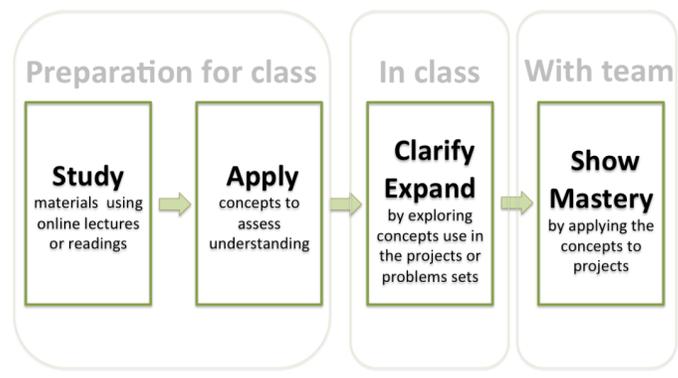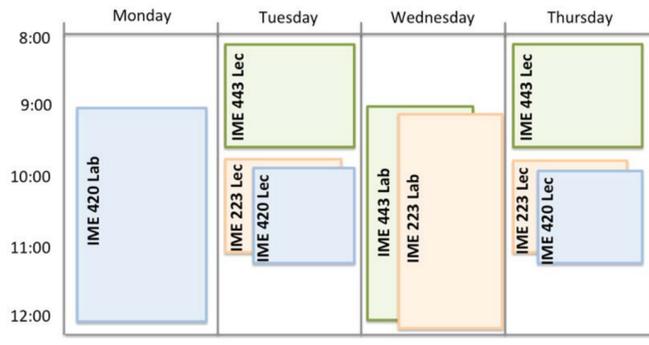

Preparation for class | In class | With team

Study materials using online lectures or readings → **Apply** concepts to assess understanding → **Clarify Expand** by exploring concepts use in the projects or problems sets → **Show Mastery** by applying the concepts to projects

Schlemer , Alptekin, Bangs. Proceedings of the 2012 ASEE PSW Section Conference, Integrating Courses Through Project Based Learning

Execution (all about change management)

1. Dedicate time to plan & design the integration across classes (Optimally 100% complete prior to start of the quarter. Build capacity to work together.)
2. Faculty openness & willingness to let go of previously held assumptions (modifying topic order or coverage). Openness to alternative teaching methods (traditional, flipped, on-line, project based, team based, etc…).
3. Behave as a team across classes (for faculty & students)
4. Faculty to model integrated behavior and communicate it to students (example faculty attend each others classes)

Students are learning for an unknown future
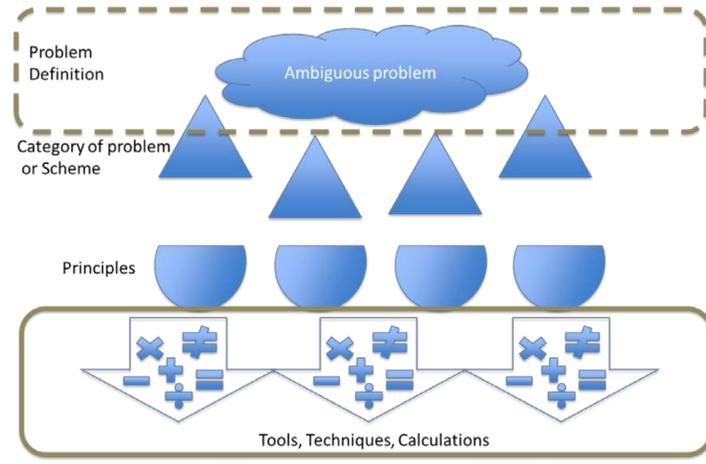
## Major Issues to Resolve

- Learn how to teach a project based learning model
- Identify best practices to initiate collaboration (within department, across the college, & across the university)
- Develop formative & summative assessments of the individual & the team
- Develop best practices to secure projects (quarter after quarter, year after year)
- Develop skill set and time to convert classes to 'flipped' model

Discussion

- Creativity breeds creativity. In a non-structured PBL mode the answer isn't formulaic. This is good for the student (representative of typical industry projects) and for the instructor (more opportunities for applications and to learn from the students as well).
- Integrating across courses increases mastery of course topics for the students.
- Integrating across class levels increases sense of community within the department.
- How can this be sustainable (our pilot wasn't extended the following year), become the culture?
- This mode makes the instructors better teachers by moving them out of the 'sage on the stage' and into a "guide on the side" role.
- This mode drives and enables student centered learning (pull vs push education… borrowed from Dr. Liz Schlemer)
- PBL enables multi-disciplinary learning
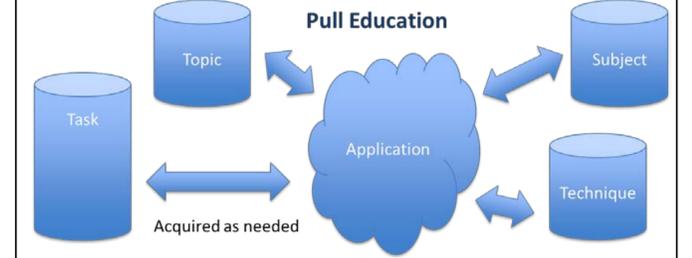
Sample response at beginning of term from a sophomore:
"I believe this assignment will be very exciting and I feel extremely lucky to be a part of it. It is also nice to have the mentors from the other class to guide us as we are at work."

Adhoc feedback post pilot class was very positive

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