Integrated Mechanical and Electrical Experience for First-year Students

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Purdue Polytechnic Summit
June 5-7, 2017
South Bend population ≈ 120,000
County population > 250,000

160 students in 7 majors
Undergraduate degrees only
Students are local residents, commute to campus
7 full-time faculty members
Polytechnic Transformation
• Promote Active Learning
• Provide Integrated Context for Content
• Work Towards Competency-based Assessment

Faculty Course Preparation
• Examine Course Learning Outcomes and Objectives
• Develop Relevant Projects and Assessments
• Change Course Schedules and Room Assignments
• Prepare Budget for Supplies and Undergraduate Teaching Assistants
All first-year Mechanical Engineering Technology (MET), Electrical and Computer Engineering Technology (ECET), and Engineering Technology (ET) students. Total number = 28

**ECET Students**
- ECET 12000 Gateway to EET
  - 3 credit hours: 2 hrs. lecture, 3 hrs. lab
- ECET 29900 Professional Issues in EET
  - 1 credit hour: 3 hrs. lab

**MET & ET Students**
- MET 14400 Materials and Processes I
  - 8 hours/week, Monday and Wednesday, 9 AM
- MET 16200 Computational and Analytical Tools
  - 12:50 PM
Students enroll only in courses for their Plan of Study. All students meet at the same time, in the same classrooms. Multidisciplinary teams are formed for project work. (students and faculty)
CONTEX FOR LEARNING

Fall 2014

What is the most effective way to analyze and present numerical results?

How are polymers used in design?

What properties are important for polymers and composites?

What are the units for energy and power?

What is the difference between AC and DC?

How do I characterize the properties of materials?

What are the units for length, force, torque, and stress?

Where should we start?

What components are used in electric circuits? What is their function?

What are the characteristics of analog and digital devices?
# Badges and Challenges

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To Earn a Grade of “A”
   All required badges + one optional badge

To Earn a Grade of “B”
   All required badges

If any required badges not earned: “F”
All first-year Mechanical Engineering Technology (MET), Electrical and Computer Engineering Technology (ECET), and Engineering Technology (ET) students. Total number = 29

**ECET Students**
- ECET 17700 DAQ and Systems Control
- ECET 17900 Introduction to Digital Systems

3 credit hours: 2 hrs. lecture 2 hrs. lab

**MET & ET Students**
- MET 14300 Materials and Processes I
- MET 11100 Applied Statics

3 credit hours: 2 hrs. lecture 2 hrs. lab

Monday and Wednesday:
- 9 AM
- 8 hours/week
- 12:50 PM
Lessons Learned – Fall 2014 and Spring 2015

- Students were confused by complicated schedule and Badge/Credential system
- Badges not sufficiently related to project completion
- Badge and credential list not “balanced” MET students seemed to have more individual work to complete
- Fall “kit assembly” project too complicated
- Students not getting enough “bench time”, could not perform simple measurement tasks
- Project work space needs to be large enough to accommodate all groups simultaneously

- Students need to start project work earlier in semester
- Independent scheduling of credential assessments (outside of class time) required a burdensome number of additional hours.
More Lessons Learned - Fall 2014 and Spring 2015

- Students need to start project work earlier in semester
- Independent scheduling of credential assessments (outside of class time) required a burdensome number of additional hours.
- Some “overlap” of learning outcomes with TECH 12000

- Significant number of MET 11100 students were not mastering course concepts. This led to a 50% “incomplete” result and an optional (for the students) summer 4-week session to resolve the incompletes. Only 50% of students attending the summer session were able to successfully pass the course.
Changes:

- drop “Badge” system. Use only “credentials”. Schedule deadline for completion in advance of end of semester.
- Link credentials more closely to robot project objectives
- Separate students by major for second half of semester “tutorials”
- Include more “bench” time for all students
- Begin robot team project near the beginning of the semester, run in parallel with “tutorials”
- Coordinate with TECH 12000 (teamwork, writing assignments, ethics..)
- Separate students by major for some content modules, to allow more focused effort on difficult topics
• Coordination with TECH 12000 was effective in avoiding overlap/concept confusion
• Closer integration of “competencies” with project provided better student motivation
• More time dedicated to MET 11100 improved “Pass” rate to 80%, without incompletes or additional summer sessions
• In-class schedule of assessments prevented end-of-semester crowding and decreased the number of additional hours for faculty
Beginning with Fall 2016:

- Curriculum changed to require all students to enroll in ENGT 18000 and ENGT 18100, Courses which integrate the analytical, computational, and basic concepts for mechanical and electrical engineering technology.
- The content from MET 16200 and ECET 12000 are now incorporated into the ENGT courses.
- The other courses are being delivered separately.
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