Redefining Engineering Education at UM

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College of Engineering
Flipped Learning Initiative – CoE Committee Members

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UMIT
Overview

1. Motivation - *Blooms Taxonomy*

2. Active Learning Cycle
   a. College of Engineering Strategic Plan (2016)
   b. Implementation of Active Learning Initiative

3. Results
   a. Faculty, TA and Student Surveys
   b. Testimonials
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Case: MEF University, Istanbul

Flipped Approach

75%: benefit from watching videos before class

89.7%: likely to recommend Flipped Learning to their student friends

89.7%: satisfied with the Flipped Learning method
1. Motivation

Traditional & Flipped Learning

Bloom’s Taxonomy

- Traditional
  - In class
  - Post-class

- Flipped
  - In class
  - Pre-class

- REMEMBER
- UNDERSTAND
- APPLY
- ANALYZE
- EVALUATE
- CREATE
1. Motivation
“Large-scale comparison of science teaching methods sends clear message”

Carl E. Wieman
Department of Physics
Stanford University
www.pnas.org/cgi/doi/10.1073/pnas.1407304111
June 2014

• Based on 225 studies in STEM courses
• **Failure rate decreased** from 34% to 22%
• **Test scores increased** by 0.47 SD
1. Motivation

"You give people lectures, and [some students] go away and learn the stuff. But it wasn't that they learned it from lecture — they learned it from homework, from assignments. When we measure how little people learn from an actual lecture, it's just really small."

-Nobel laureate Carl Wieman

Professor of Physics, Stanford
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2. Active Learning Cycle

- CoE Strategic Plan
- Active Learning Initiative
- Educational Innovation Seminar Series
- Faculty Workshops (summer & winter)
- Technology Selection & Implementation
- Classroom Preparation
- Course Selection & Delivery
- Assessments
- Monthly Meetings
- TA Training
- Faculty Training

Continuous Improvement

Excellence in Research
Becoming Innovation Hub of Miami
Implement Agile & Transparent Administration
Develop a Culture of Belonging
Redefining Engineering Education
2a. College of Engineering Strategic Plan

Initiation

November 3, 2016

College of Engineering Strategic Plan Announced
2a. College of Engineering Strategic Plan

Mission of the College of Engineering

The College of Engineering transforms lives by:

- Creating new knowledge
- Re-creating knowledge for students
- Providing exemplary service to the community
- Translating knowledge for commercialization, and
2a. College of Engineering Strategic Plan

STRATEGIC PLANNING PROCESS

UM
“Roadmap to a New Century”

CoE and Department Goals

- Listened to Understand (Aug. - Dec. 2015)
- Built the Roadmap Together (Jan. - May 2016)

CoE Advisory Committees

Strategic Implementation

- First Actions (Nov. - Dec. 2016)
- Implement Remaining Initiatives (2017 - 2021)
2a. College of Engineering Strategic Plan

Redefine Engineering Education

a. Enable Makerspace Opportunities: Build-out of the 5,850-square-foot collaborative lab is underway, in partnership with Johnson & Johnson. When it is completed early next year, it will include high-tech additive manufacturing equipment, advanced 3-D printers and fabricating equipment. A full-time engineer/scientist will staff the lab.

b. Use Flipped Classrooms: Two flipped classrooms will be completed. These classrooms reverse the traditional learning environment: instructional content is delivered online outside the classroom, and the classroom is used for teamwork activities.

c. Reform Freshman Introductory Courses: CoE faculty and staff will discuss the curriculum for introductory courses that all freshmen engineering students will take – regardless of discipline.

d. Expand Professional Master of Science Programs: We will begin adapting our curriculum to launch new industry-driven professional Master of Science degree programs in all departments.
2b. Implementation of Active Learning Initiative

1. Classroom Preparation
   McArthur Engineering Annex Room 220

2. Faculty Training
   - UM Academic Technologies LIFE
   - Faculty Learning Community
   - Selection of Technology tools (Blackboard, Camtasia, Kaltura, Polleverywhere, ...)

3. Selection of Courses
2b. Implementation of Active Learning Initiative

Classroom Preparation

- TV units (55")
- TV Stands
- TV Locks
- Epson Smart Projector/Document Camera
- Epson Smart Projector Training
- Linksys Router
- Chromecast
- 8 Port HDMI Splitter
- AirServer
- Power Stations
- Mobile White boards
- Desktop Security Box
- Desktop PC
- HDMI Cables
2b. Implementation of Active Learning Initiative

<table>
<thead>
<tr>
<th>Date</th>
<th>Event Description</th>
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<tbody>
<tr>
<td>November 14, 2016</td>
<td>College of Engineering Active Learning Initiative</td>
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<td>First Committee Meeting</td>
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<td>December 9, 2016</td>
<td>Committee Members Training – Active Learning</td>
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<td>January 13, 2017</td>
<td>Faculty Training – Active Learning</td>
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<td><strong>January 17, 2017</strong></td>
<td><strong>Select classes begin in MEA 220 Active Classroom</strong></td>
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<tr>
<td>March 23, 2017</td>
<td>Blackboard training for College Teaching Assistants</td>
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<td>March 30, 2017</td>
<td>Smart Projector Training</td>
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<td>April 27, 2017</td>
<td>Blackboard Outcomes Demo</td>
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2b. Implementation of Active Learning Initiative

Initiation: Hands-on Workshops

Faculty Training
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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<tbody>
<tr>
<td>ECE 201</td>
<td>Electrical Circuit Theory</td>
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<tr>
<td>MAE 301</td>
<td>Engineering Materials Science</td>
</tr>
<tr>
<td>CAE 404</td>
<td>Civil, Architectural and Environmental Engineering</td>
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<td></td>
<td>Senior Design</td>
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<tr>
<td>BME 401</td>
<td>Biomedical Engineering Senior Project</td>
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<tr>
<td>BME 480</td>
<td>Biomedical Instrumentation</td>
</tr>
<tr>
<td>IEN 512</td>
<td>Statistical Quality Control and Quality Management</td>
</tr>
<tr>
<td>IEN 570</td>
<td>Engineering Management</td>
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2b. Implementation of Active Learning Initiative

Monthly Meetings for Faculty
2b. Implementation of Active Learning Initiative

CoE Blackboard Workshop

The CoE partnered with Academic Technologies to hold a hands-on Workshop on Blackboard use for TA’s on March 23, 2017
Advantages

Improved Knowledge Retention
Deeper Understanding of Material
Engagement
Self-directed learning
Problem-based and Team-based learning
Student-centered
Method works for all class sizes
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3. Results

University of Miami
College of Engineering
Active Learning Initiative

Faculty Survey Results
Q1 - My students are engaged in projects/problems I present in class

Q2 - My students are eager to work in groups
Faculty Survey Results

Q3 - My students present their findings enthusiastically

Q4 - I witness students learning at a deeper level in an active classroom
The Active Learning Initiative made a tremendous impact in our Senior Design course. It increased the connectivity and communication between faculty & students and between students within the multi-disciplinary teams. It engaged and motivated students more than previously used teaching techniques. It is an extremely effective teaching methodology.

Matthew Trussoni, PhD, AIA, PE
Dept. of Civil, Architectural & Environmental Engineering
Faculty Survey Results

Q5 - I am interested in teaching my other courses in a “flipped/active” way

- **Strongly Agree**: 33%
- **Agree**: 50%
- **Somewhat agree**: 17%

Q6 - I would recommend other faculty to use the “flipped/active” approach

- **Strongly Agree**: 33%
- **Agree**: 50%
- **Somewhat agree**: 17%
Summarize Active Learning (one to three words)

Poll locked. Responses not accepted.
3. Results

University of Miami
College of Engineering
Active Learning Initiative

Teaching Assistants (TA) Survey Results

March 2017
Q1 - Please indicate how useful you found the workshop elements detailed: **Grading assignment**

**Q14_8 - Grading assignment**

- 50% Extremely useful
- 42% Very useful

Q2 - Please indicate how useful you found the workshop elements detailed: **Calculating grades.**

**Q14_26 - Calculating grades**

- 67% Extremely useful
- 33% Very useful
3. Results

University of Miami
College of Engineering
Active Learning Initiative

Undergraduate Student Survey Results

79 Responses

March 2017
Student Survey Results

Q1 - I am knowledgeable about active learning and flipped classrooms

Q2 - I am knowledgeable about the technologies used (blackboard) for pre-class activities
Q3 - The pre-class learning material/videos for each topic helped me prepare for the in-class activity

Q4 - The pre-class assessment questions for each topic helped me assess how prepared I was for the in-class learning activities
Flipped/active learning activities was a great experience and got me more engaged during class. I was able to do a lot of learning on my own and with my peers. It helped me to achieve better learning outcomes when learning actively compared to passively listening to lectures.

Ayoub Al Yusuf

Industrial Engineering
Q5 - I prefer reviewing lecture materials and resources before class, than in class

Q6 - The **in-class** assessment questions helped me construct explanations and solutions
Student Survey Results

Q7 - The in-class problem-based activities enabled me to understand the topic in a deeper way.

Q8 - The in-class discussions with my fellow students helped me understand fundamental concepts in this class.
Transforming class time into that in which can be shared with your classmates through activities was very beneficial. It allowed for us to immediately work on charts/data/analysis that was explained to us a couple minutes prior. This in turn made homework and exams easier as we were able to connect it back to what was done in class.

Daniela Martinez
Industrial Engineering
Q9 - The **in-class** discussions with my instructor assisted me in understanding the topic.

Q10 – I would rather work on in-class activities rather than the Professor lecture during class hours.
The active learning classroom provided my classmates and I with the opportunity to experience hands-on learning. I felt engaged during class, and was able to work on solving real, applied problems with a group of my peers. This classroom set up provided us with the opportunity to bounce ideas off of each other, which ultimately helped us learn from each other and grow as engineers.

Colleen Plesac
Biomedical Engineering
Class of 2017
Q11 - My communication skills have developed with this flipped class

Q12 - I was able to use the technologies available in the classroom at ease
Statistical Quality Control and Quality Management was the first class I have taken in MEA 220, the interactive nature of the classroom was extremely helpful. The assignments given in class allowed us to practice our presentation skills. Being able to sit in our groups and work on activities together helped us bond as well as accomplish activities quickly and effectively.

Jasmine Pattany
Industrial Engineering
Student Survey Results

Q13 - I would recommend this "flipped course" to others

Q14 - Given the option between traditional lectures and flipped courses, I would select courses that are “flipped”
The Flipped Classroom offered interactive learning between the professors and students. Not only were we able to display our projects on screen, but the group could visualize what was being talked about. It was also a great tool when it came to get feedback from professors; as well as an aid when it came to presenting to the class.
If you hesitate to adopt active learning in your teaching, come and visit our flipped classrooms. You will see small groups of engaged students guided by instructors. All collaborate intensively together. Nobody dozes off or checks emails and social media. Overall students learn much better than in traditional lectures.

Jean-Pierre Bardet
Dean, College of Engineering
Thank you

http://www.coe.miami.edu