Redefining Engineering Education at UM

Derin Ural, PhD
College of Engineering

Flipped Learning Initiative – CoE Committee Members

Dr. J.P. Bardet, Dean, College of Engineering

Dr. Hammam Alsafrjalani, Assistant Professor in Practice, Dept. of Electrical and Computer Engineering

Ms. Ana Ayala, Director of Finance and Administration, College of Engineering

Dr. Ines Basalo, Assistant Professor in Practice, Dept. of Mechanical and Aerospace Engineering

Dr. Jorge Bohorquez, Associate Professor in Practice, Dept. of Biomedical Engineering

Dr. Nina DeCario Miville, Assistant Professor in Practice, Dept. of Industrial Engineering

Mr. Francisco Duarte, Building Facility Coordinator, College of Engineering

Dr. Ram Narasimhan, Assistant Professor in Practice, Dept. of Industrial Engineering

Dr. Michael Scordilis, Associate Professor in Practice, Dept. of Electrical and Computer Engineering

Mr. Troy Thompson, Director of Building Facilities, College of Engineering

Dr. Matthew Trussoni, Assistant Professor in Practice, Dept.of Civil, Architectural and Environmental Engineering

Dr. Derin Ural, Visiting Professor and Working Group Chair

Flipped Learning Initiative Team

Ms. Gemma Henderson, *Senior Instructional Designer*
LIFE | Learning Innovation and Faculty Engagement
Academic Technologies | UMIT

Ms. Nathalie Molina, *Senior Instructional Designer*
LIFE | Learning Innovation and Faculty Engagement
Academic Technologies | UMIT

Mr. Rick Ramos, *Help Desk Supervisor, UMIT*

Dr. William Vilberg, *Assistant Director of Learning Platforms*
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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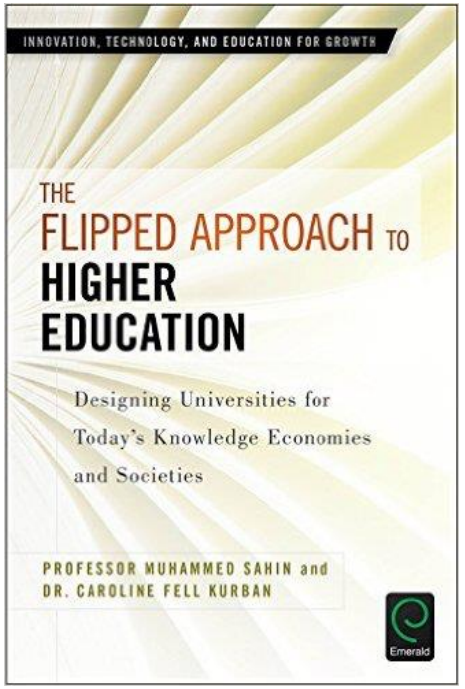
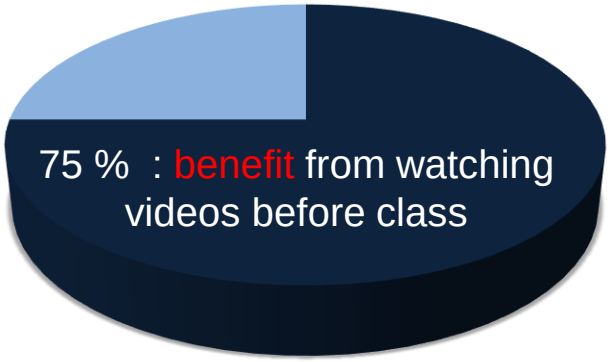
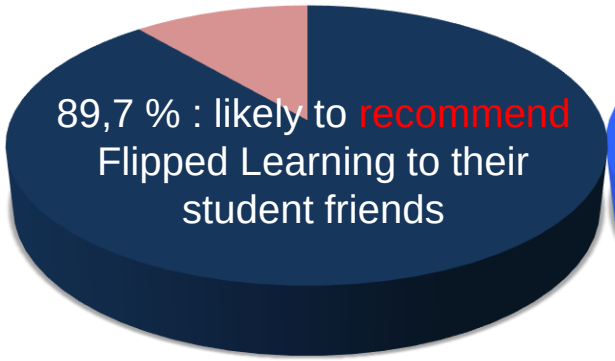
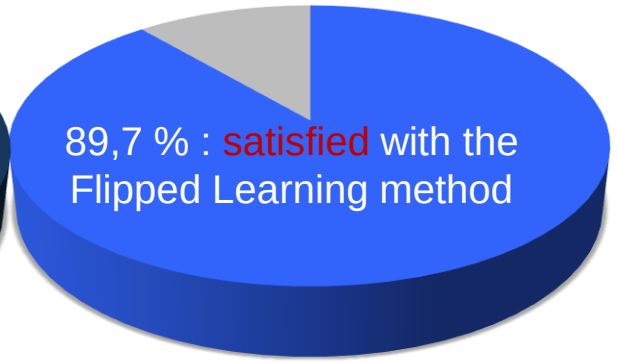
Case: MEF University, Istanbul
Flipped Approach

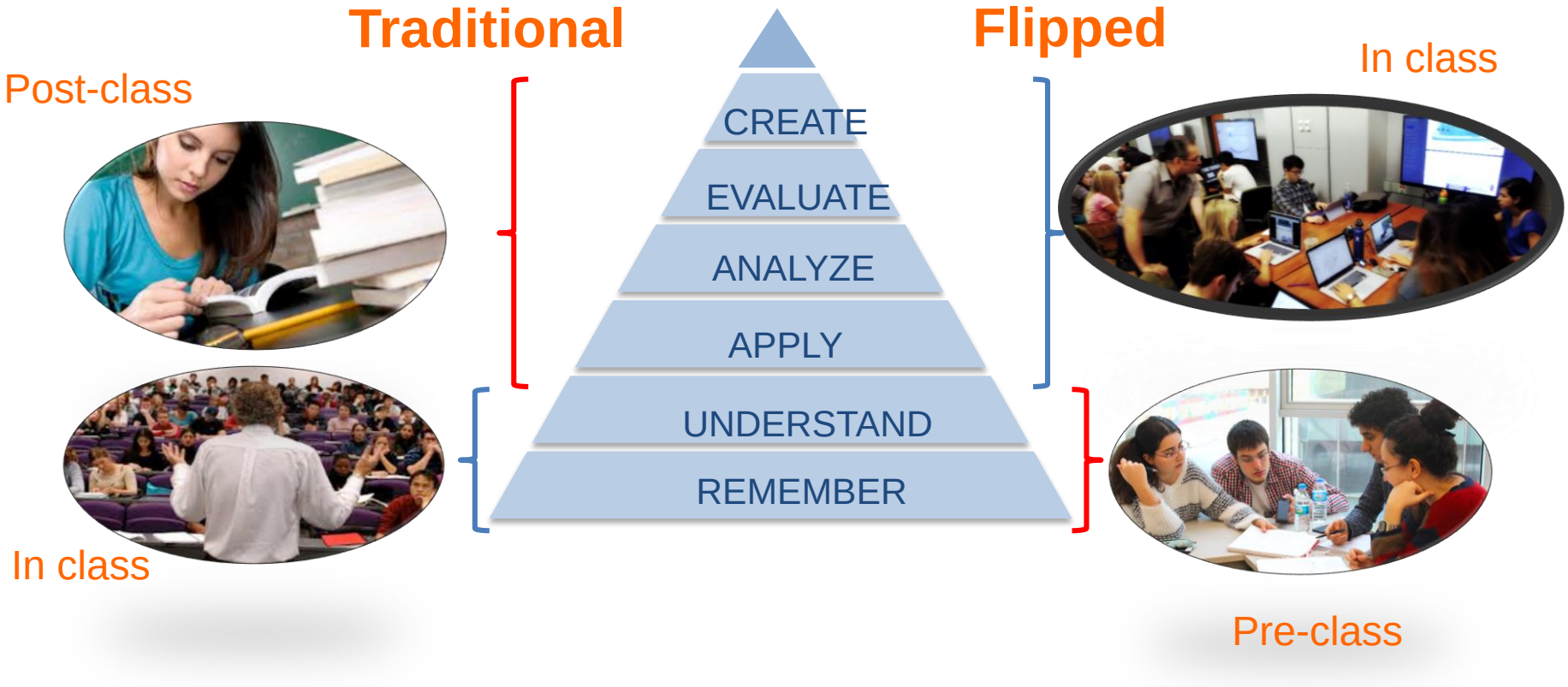






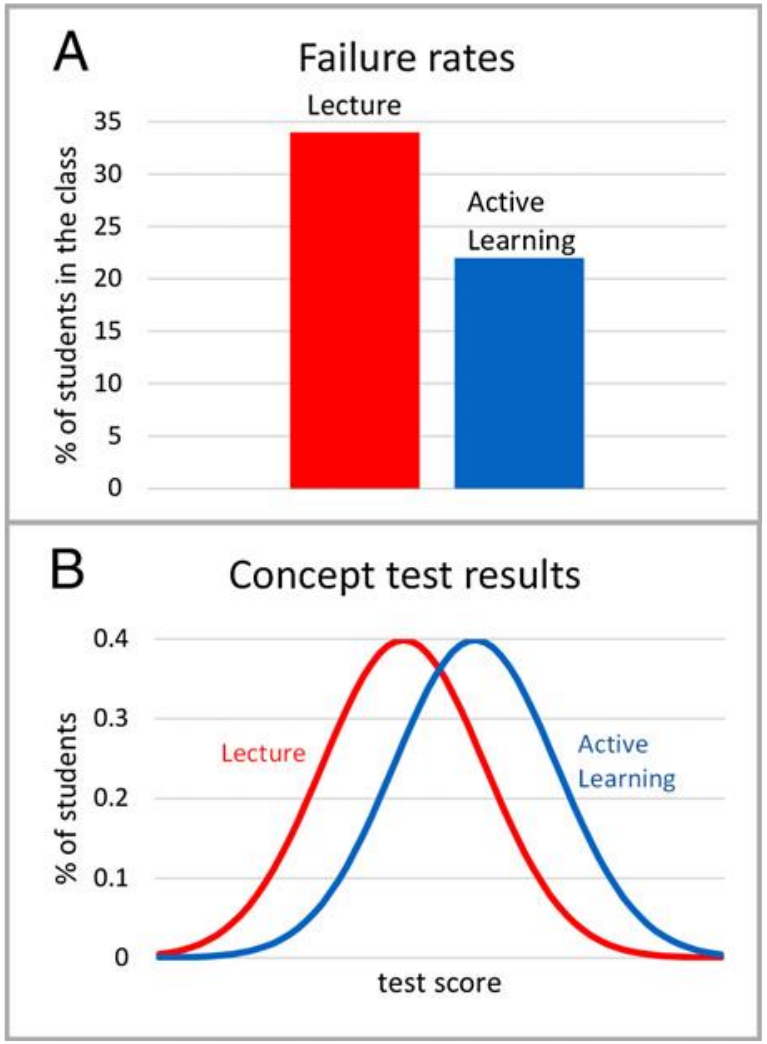


1. Motivation
Traditional & Flipped Learning
Bloom's Taxonomy



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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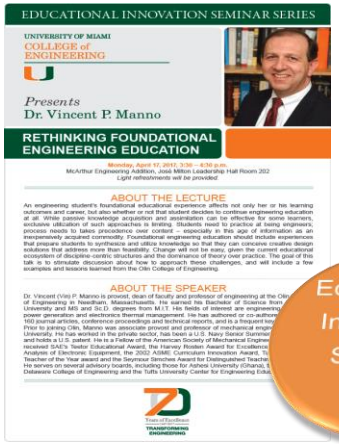
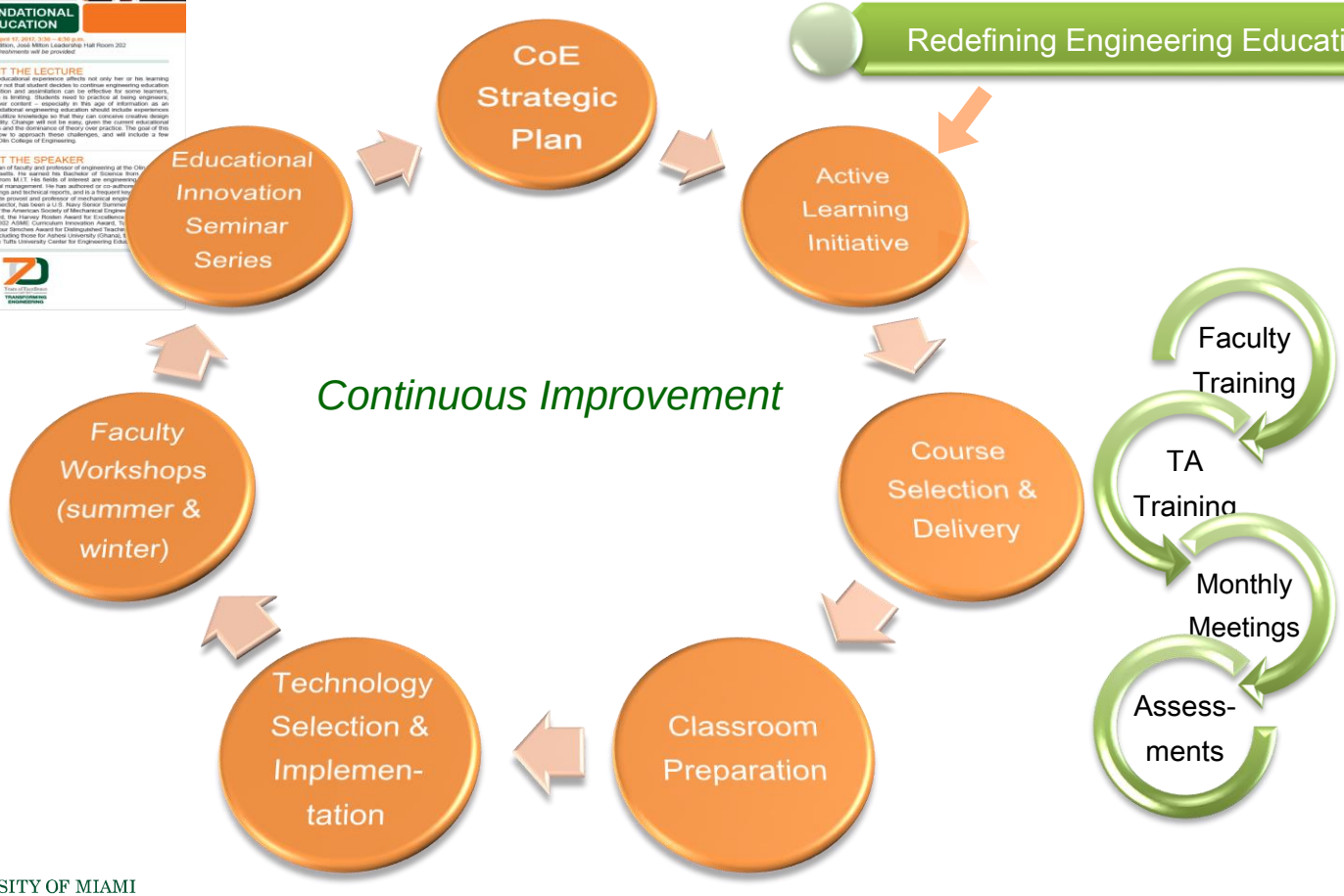
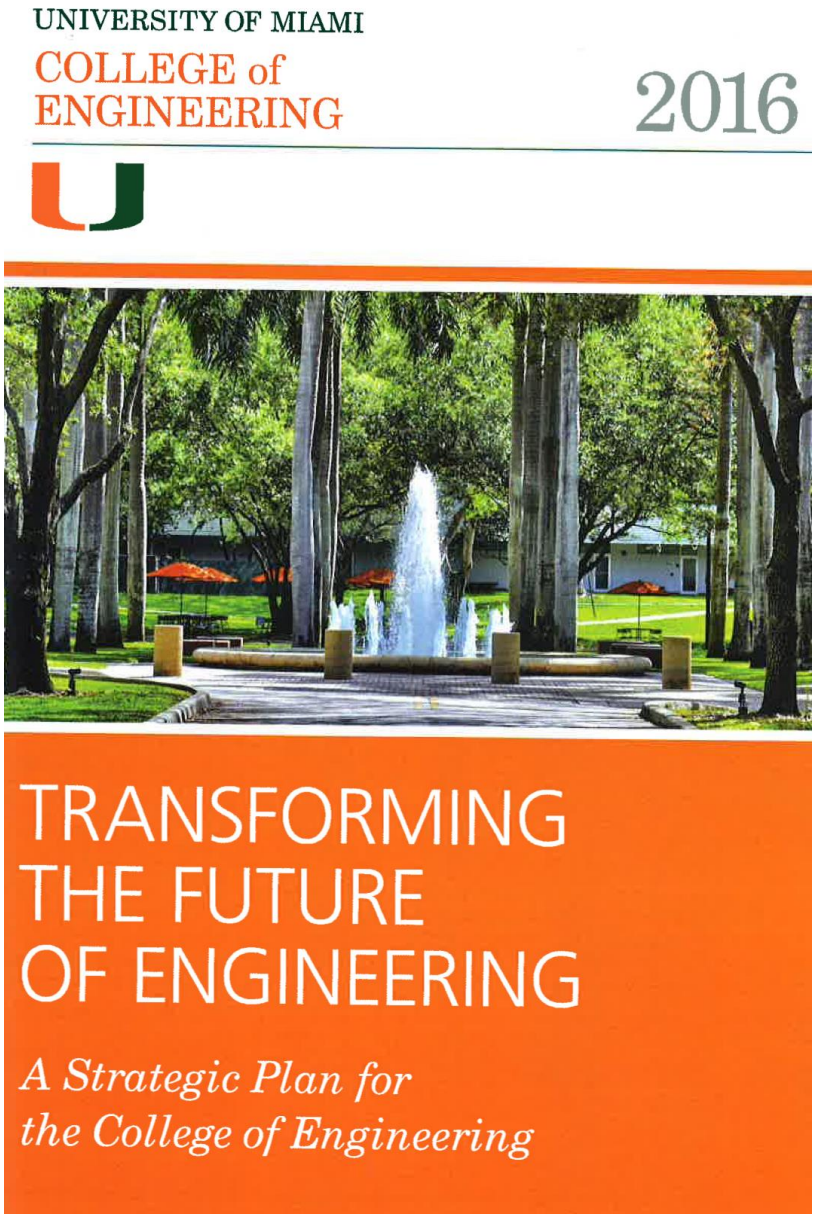
2. Active Learning Cycle

- 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

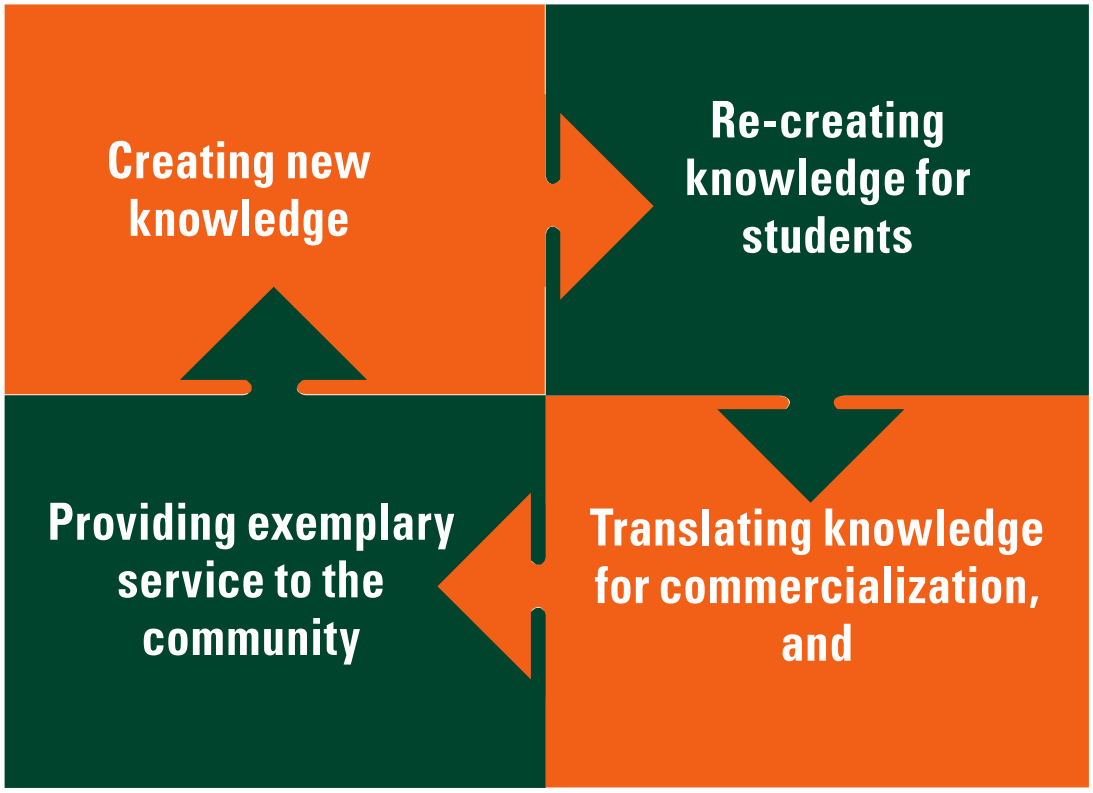
College of Engineering Strategic Plan

Announced

2a. College of Engineering Strategic Plan

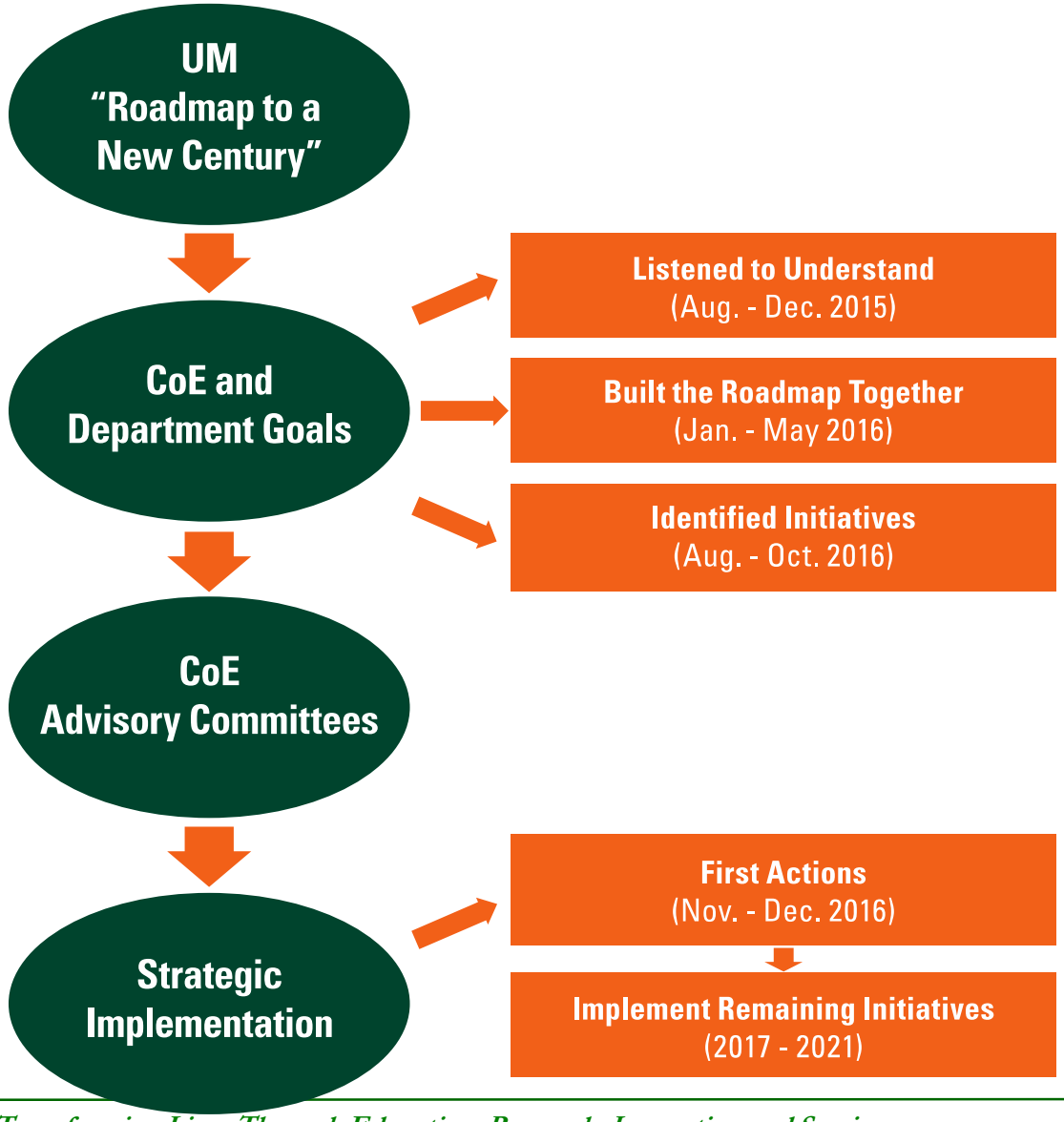
Mission of the College of Engineering

The College of Engineering transforms lives by:



2a. College of Engineering Strategic Plan

STRATEGIC PLANNING PROCESS



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**

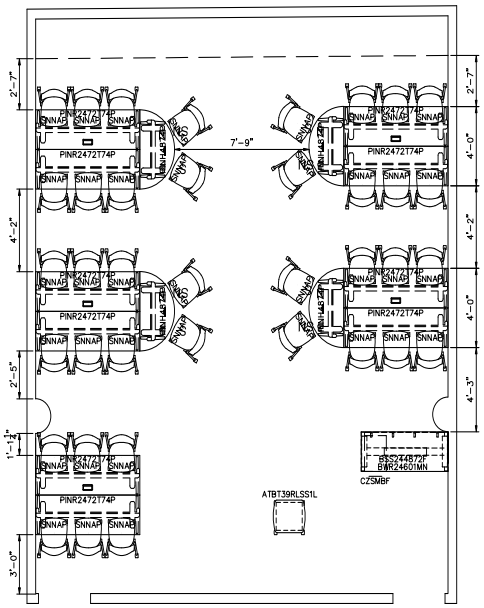
   - UM Academic Technologies LIFE
   - Faculty Learning Community
   - Selection of Technology tools (Blackboard, Camtasia, Kaltura, Polleverywhere, ...)

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



ITEM	QTY	MODEL NUMBER: OPTIONS	TAG	DESCRIPTION
1	1	ATBT39RLS-74P-S1L	ATBT39RLSS1L	ALL TERRAIN 39" BINDER TOWER,SHELF/SHELF W/OTRGGRS,MBL LCTRN-SHAPED,74P EDGE,STEEL/INSET PLASTIC (HINGE LEFT),22X20"D
2	5	PINR2472T-74P: 1PG: NMP	PINR2472T74P	PIROUETTE,NESTING TRAINING,RECTANGULAR,24X72",74P EDGE
3	5	PINR2472T-74P: NNN: NMP	PINR2472T74P	PIROUETTE,NESTING TRAINING,RECTANGULAR,24X72",74P EDGE
4	1	CZBSS244872/F	BSS244872F	CZ 24" SINGLE-SIDED STANDALONE/STARTER TELESCOPIC BEAM FRAME 48-72",FIXED,STANDARD HEIGHT
5	1	CZBWR24601MP-74P: N	BWR24601MN	CZ 24" DEEP RECTILINEAR WORKSURFACE,SINGLE-SIDED,STANDARD HEIGHT, NO-POWER,W/MODESTY PANEL,24X60,74P EDGE
6	1	CZPDS24MBF	CZSMBF	CZ MOBILE PEDESTAL,STEEL SHELL,STEEL DRAWER,BOX/FILE,24" NOMINAL DEPTH
7	4	PINH48-74P	PINH4874P	PIROUETTE,NESTING HALF ROUND,48",74P EDGE
8	38	SNNAP	SNNAP	STRIVE NESTING ARMLESS CHAIR,POLY

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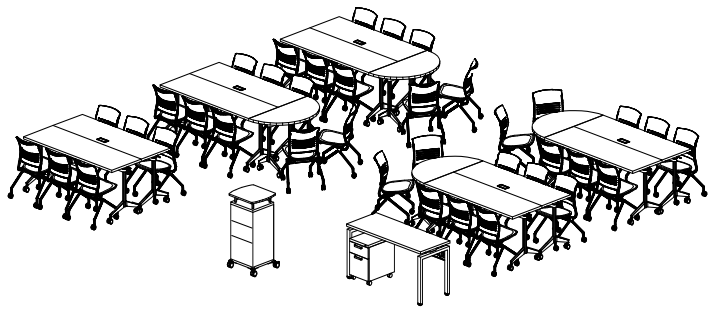


2b. Implementation of Active Learning Initiative

November 14, 2016	College of Engineering Active Learning Initiative First Committee Meeting
December 9, 2016	Committee Members Training – Active Learning
January 13, 2017	Faculty Training – Active Learning
January 17, 2017	***Select classes begin in MEA 220 Active Classroom***
March 23, 2017	Blackboard training for College Teaching Assistants
March 30, 2017	Smart ProjectorTraining
April 27, 2017	Blackboard Outcomes Demo

2b. Implementation of Active Learning Initiative

Initiation : Hands-on Workshops

Faculty Training

2b. Implementation of Active Learning Initiative

Course Selection : Spring 2017 Semester

ECE 201	Electrical Circuit Theory
MAE 301	Engineering Materials Science
CAE 404	Civil, Architectural and Environmental Engineering Senior Design
BME 401	Biomedical Engineering Senior Project
BME 480	Biomedical Instrumentation
IEN 512	Statistical Quality Control and Quality Management
IEN 570	Engineering Management

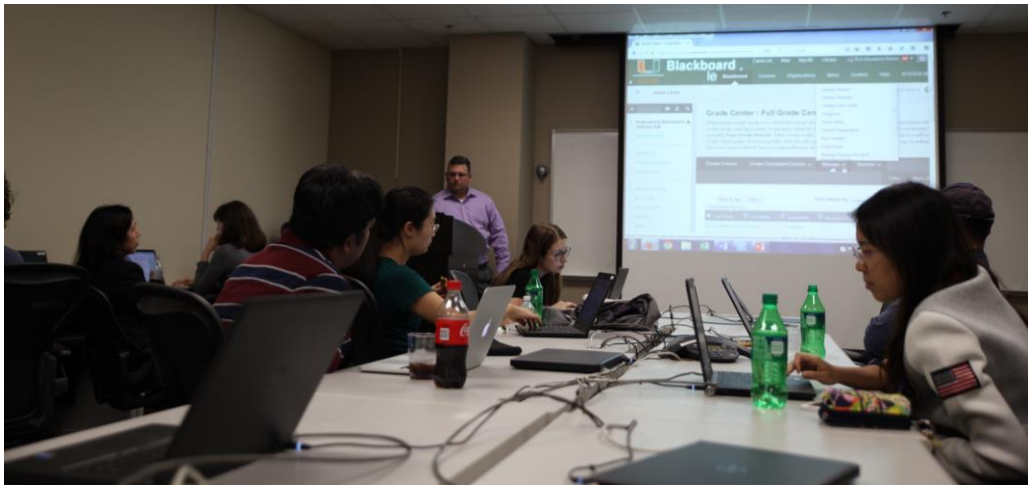
2b. Implementation of Active Learning Initiative

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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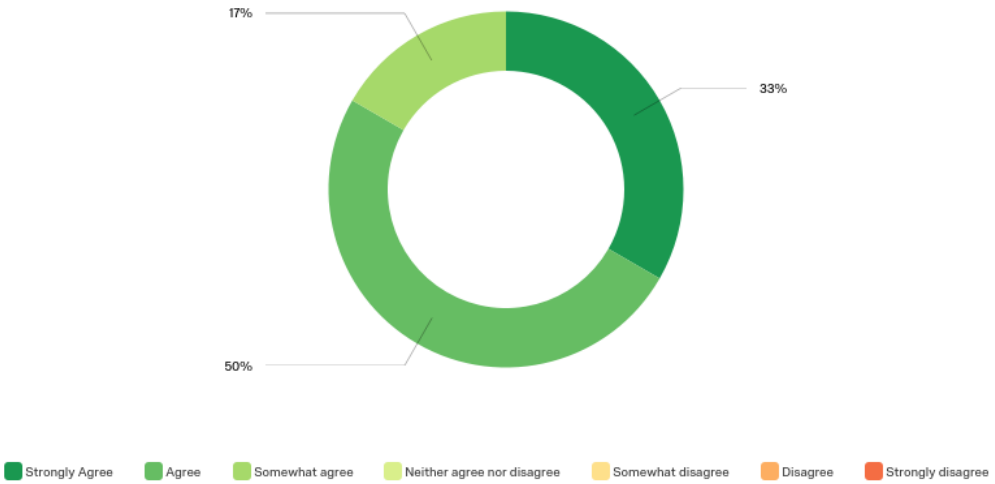
3. Results

University of Miami
College of Engineering
Active Learning Initiative

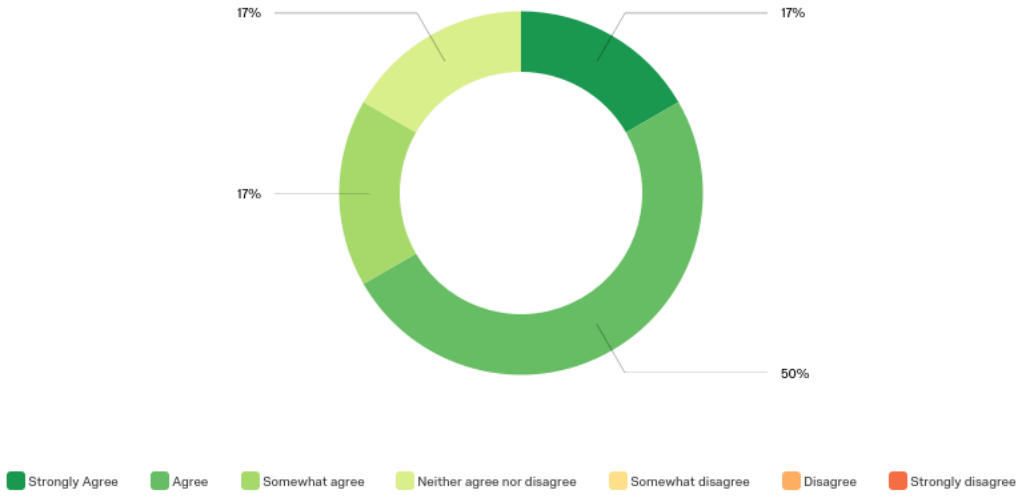
Faculty Survey Results

Faculty Survey Results

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

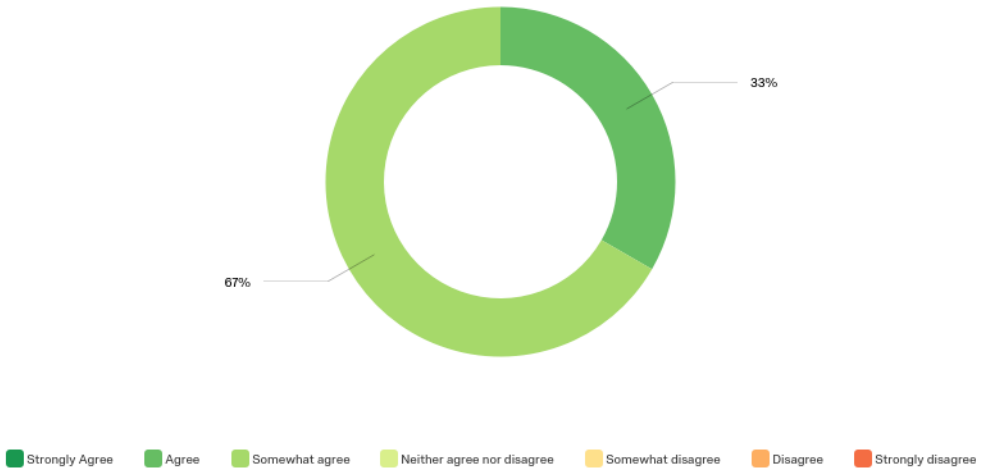


Q2- My students are eager to work in groups

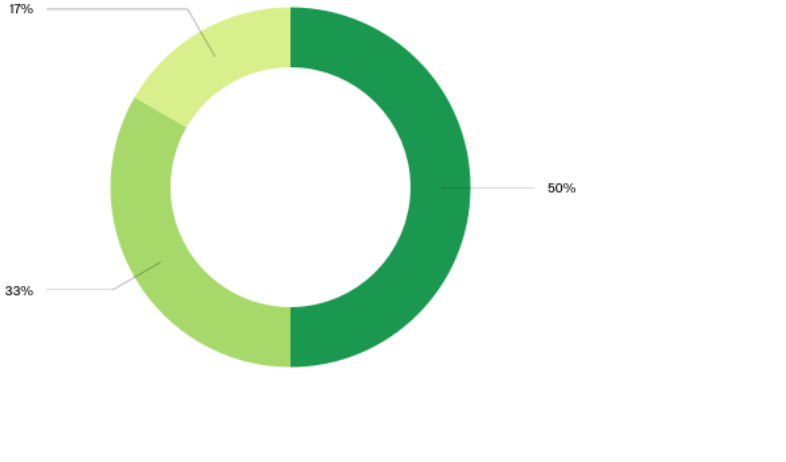


Faculty Survey Results

Q3 - My students present their findings enthusiastically



Q4 - I witness students learning at a deeper level in an active classroom



College of Engineering
Active Learning Initiative

Faculty Testimonial

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.

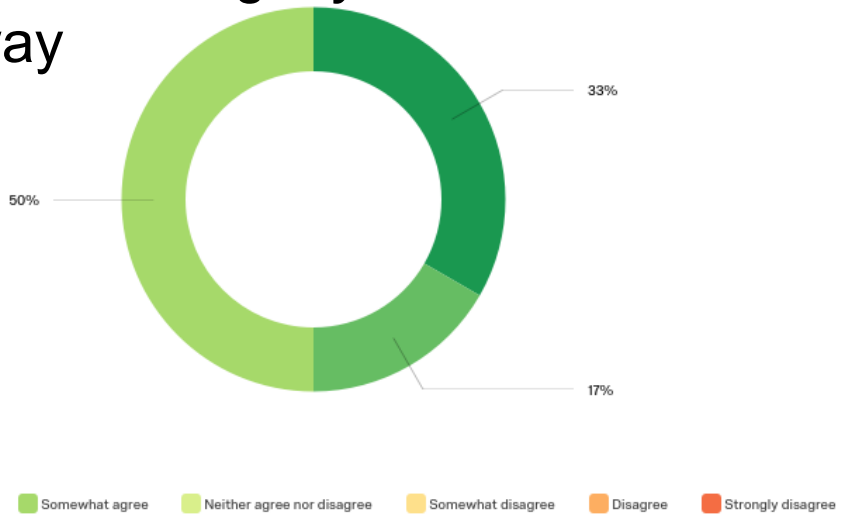
Matthew Trussoni, PhD, AIA, PE

Dept. of Civil, Architectural & Environmental Engineering

UNIVERSITY OF MIAMI
COLLEGE of ENGINEERING

Faculty Survey Results

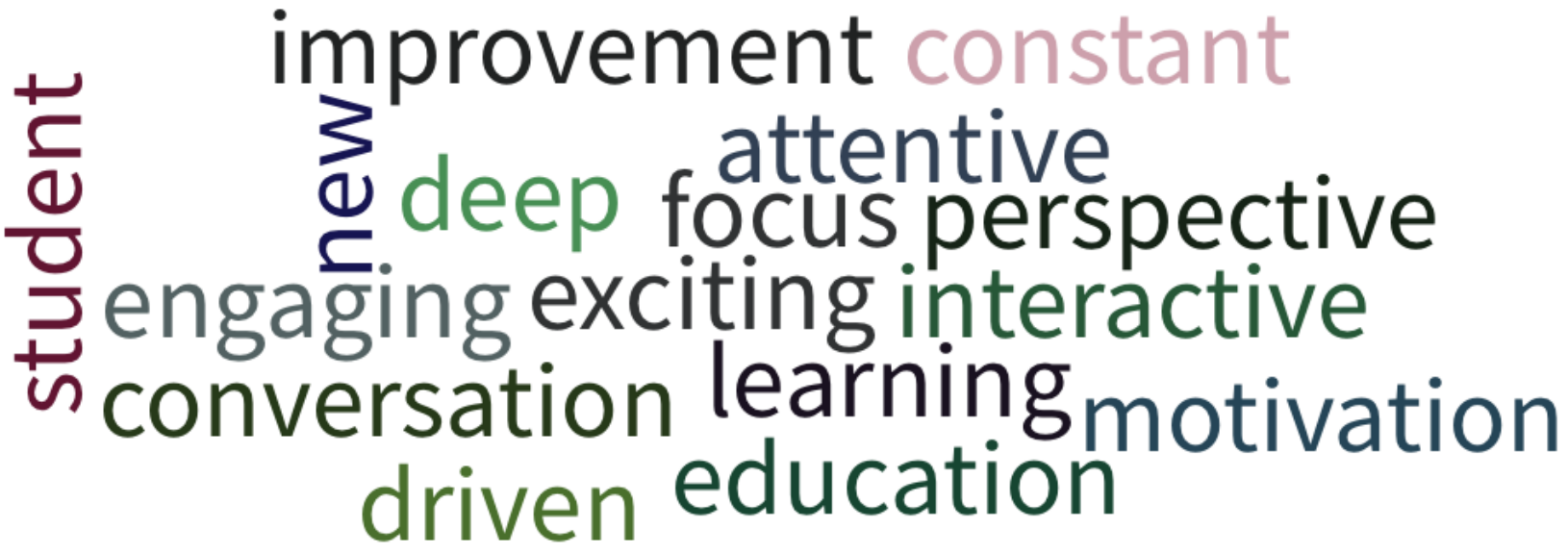
Q5 - I am interested in teaching my other courses in a "flipped/active" way



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

Summarize Active Learning (one to three words)

Poll locked. Responses not accepted.



Poll Everywhere

3. Results

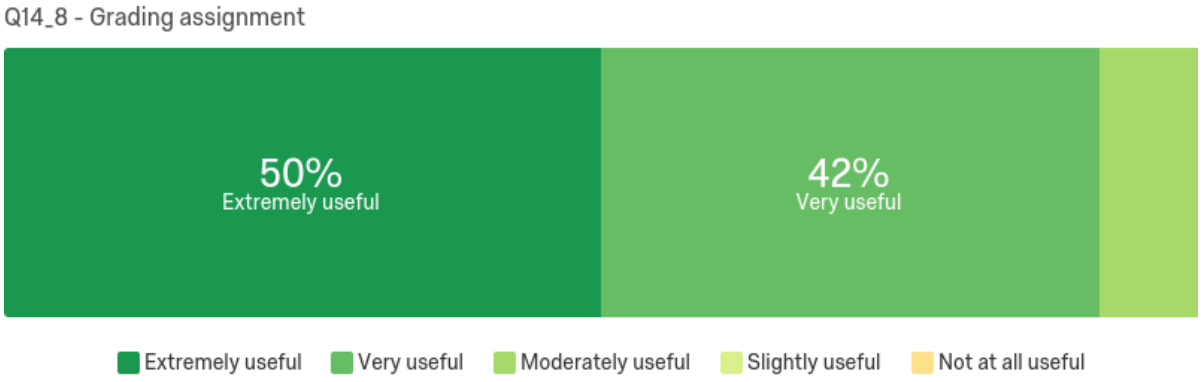
University of Miami
College of Engineering
Active Learning Initiative

Teaching Assistants (TA) Survey Results

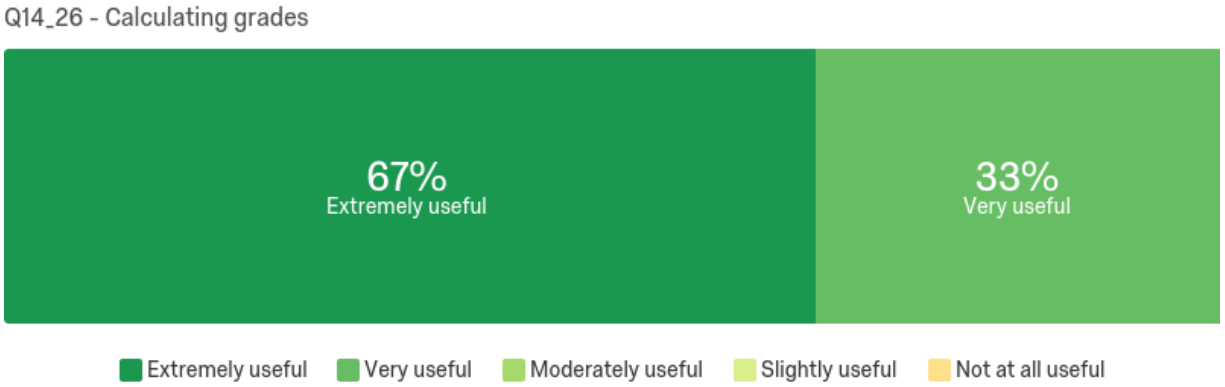
March 2017

TA Survey Results

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



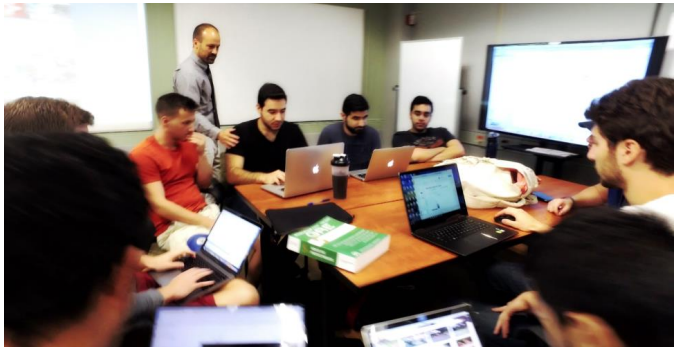
Q2 - Please indicate how useful you found the workshop elements detailed: Calculating grades.



3. Results

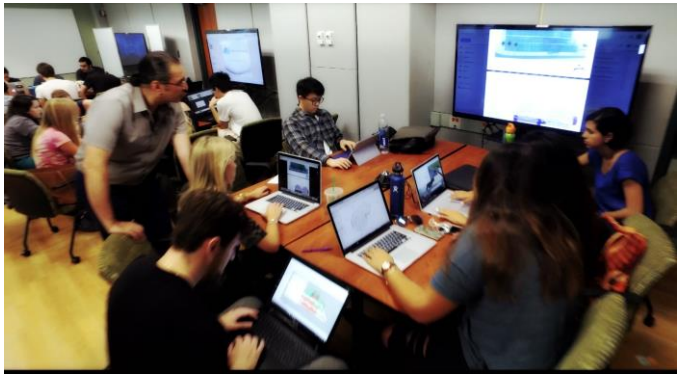
University of Miami
College of Engineering
Active Learning Initiative

Undergraduate Student Survey Results



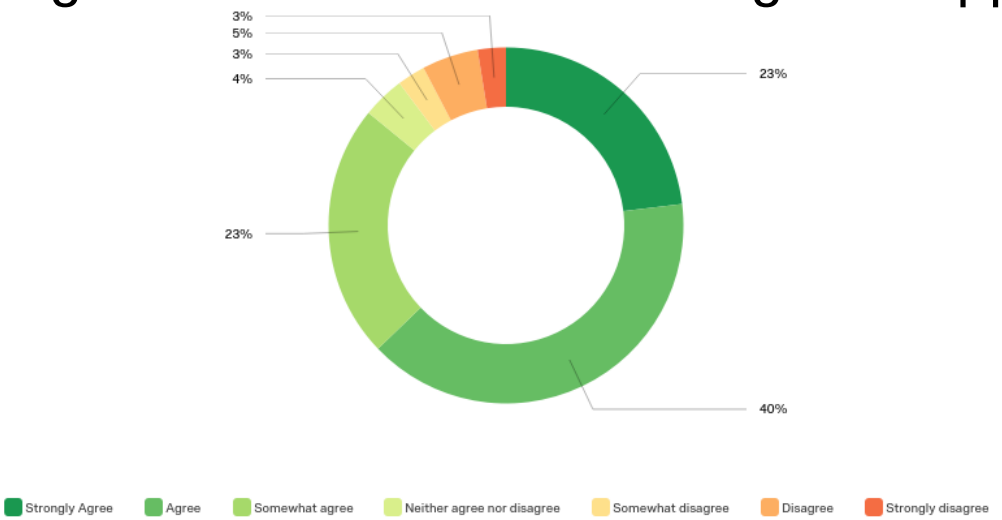
79 Responses

March 2017

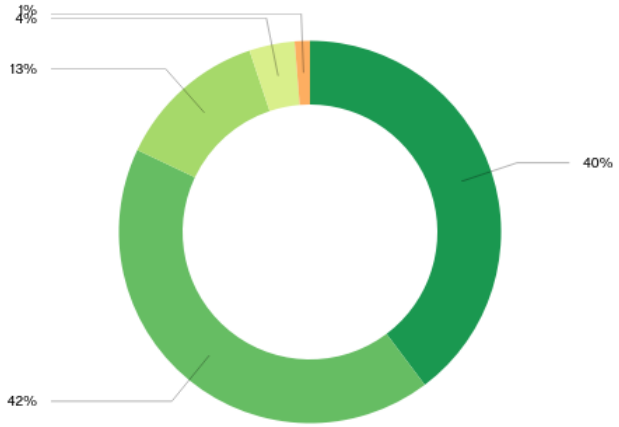


Student Survey Results

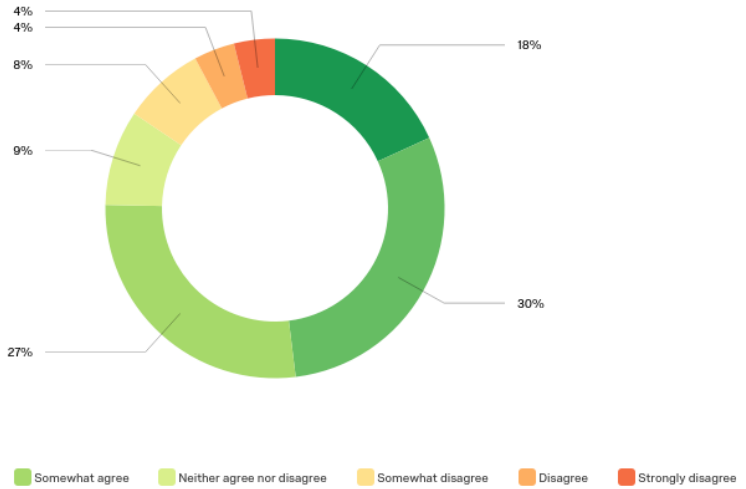
Q1- I am knowledgeable about active learning and flipped classrooms



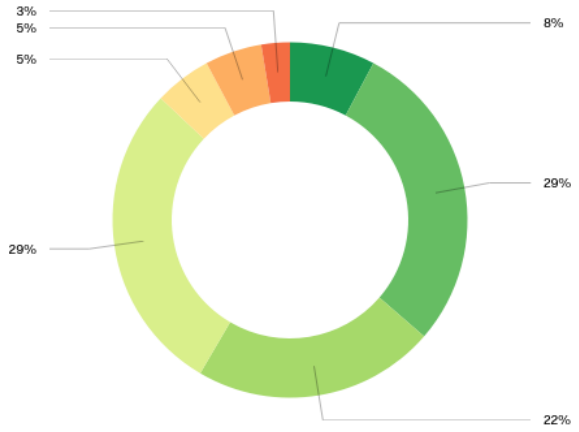
Q2 - I am knowledgeable about the technologies used (blackboard) for pre-class activities



Q3 - The pre-class learning material/videos for each topic helped me prepare for the in-class activity

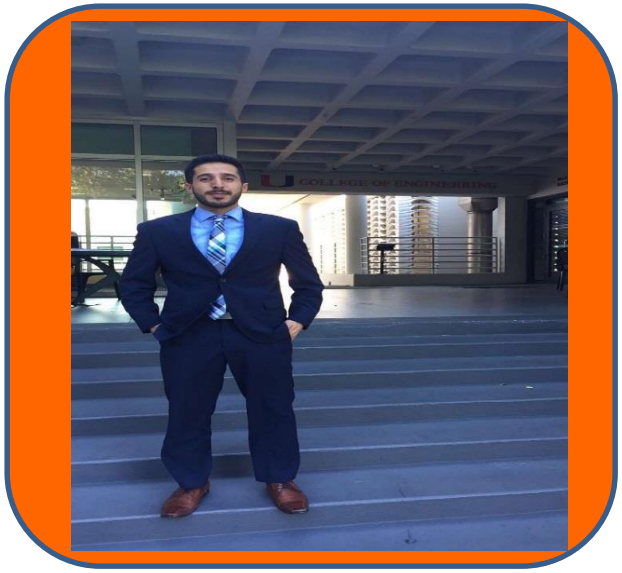


Q4 - The pre-class assessment questions for each topic helped me assess how prepared I was for the in-class learning activities



College of Engineering
Active Learning Initiative

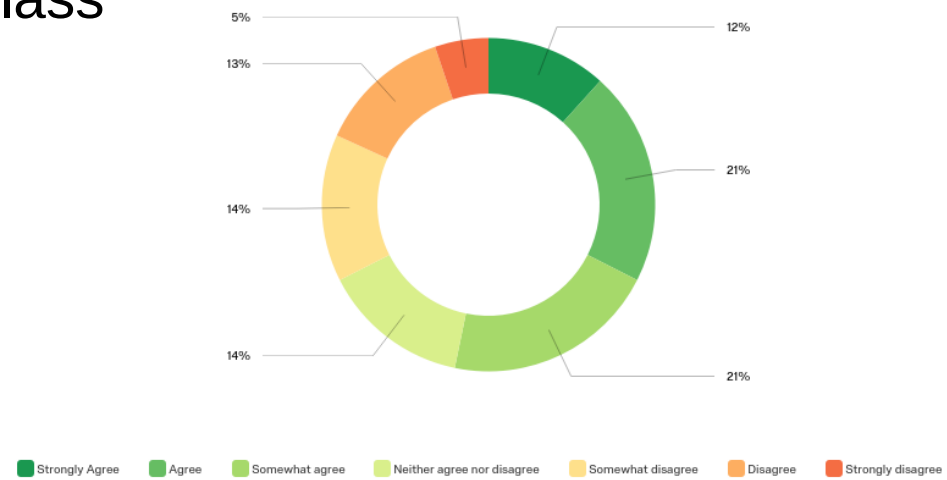
Flipped/active learning activities was a great experience and got me more engaged during class. I was able to do a lot of learning on my own and with my peers. It helped me to achieve better learning outcomes when learning actively compared to passively listening to lectures.



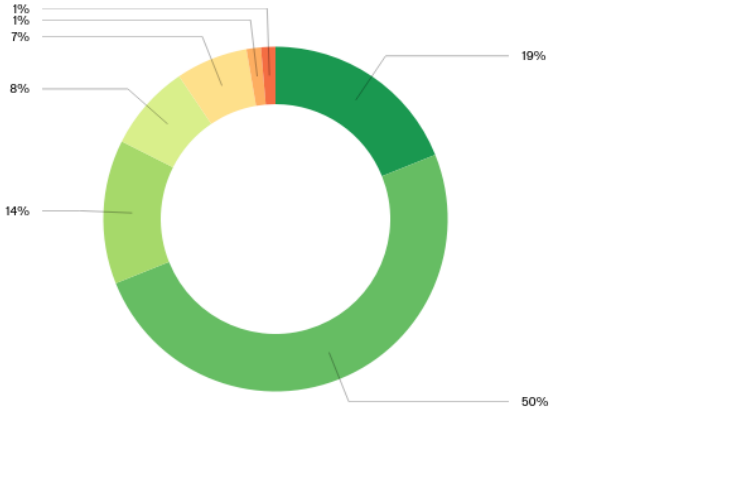
Ayoub Al Yusuf

Industrial Engineering

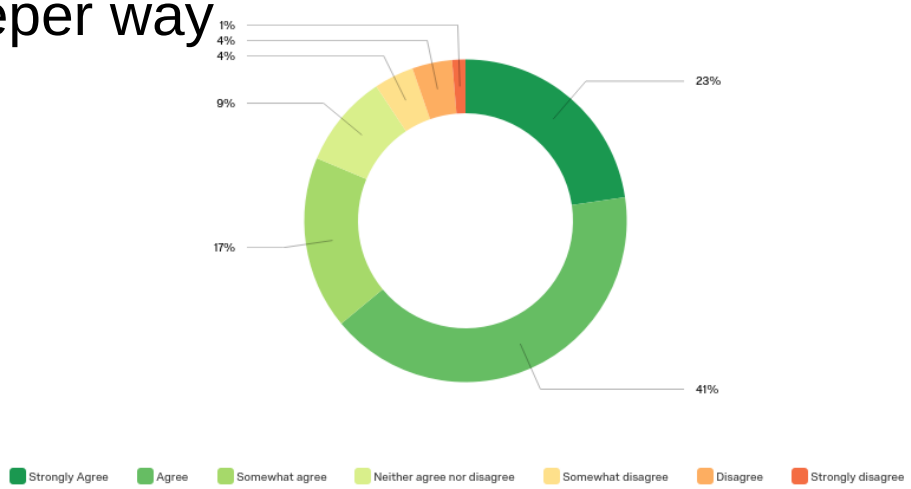
Q5 - I prefer reviewing lecture materials and resources before class, than in class



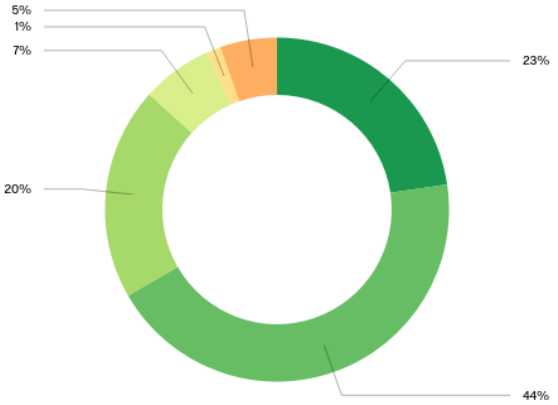
Q6 - The <u>in-class</u> assessment questions helped me construct explanations and solutions



Q7 - The <u>in-class</u> problem-based activities enabled me to understand the topic in a deeper way



Q8 - The <u>in-class</u> discussions with my fellow students helped me understand fundamental concepts in this class



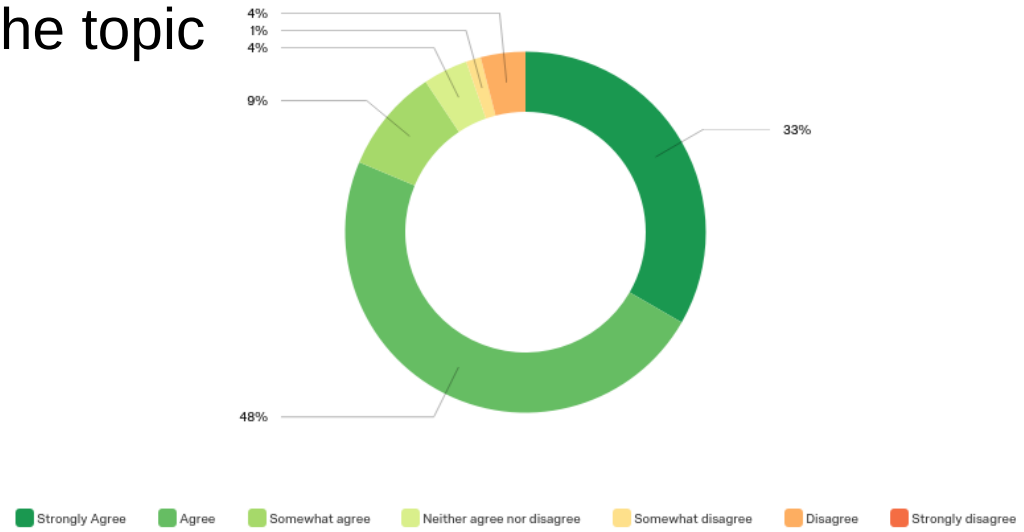
College of Engineering
Active Learning Initiative

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.

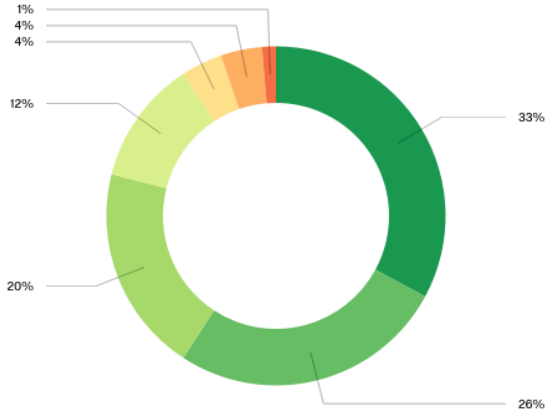
Daniela Martinez

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



College of Engineering
Active Learning Initiative

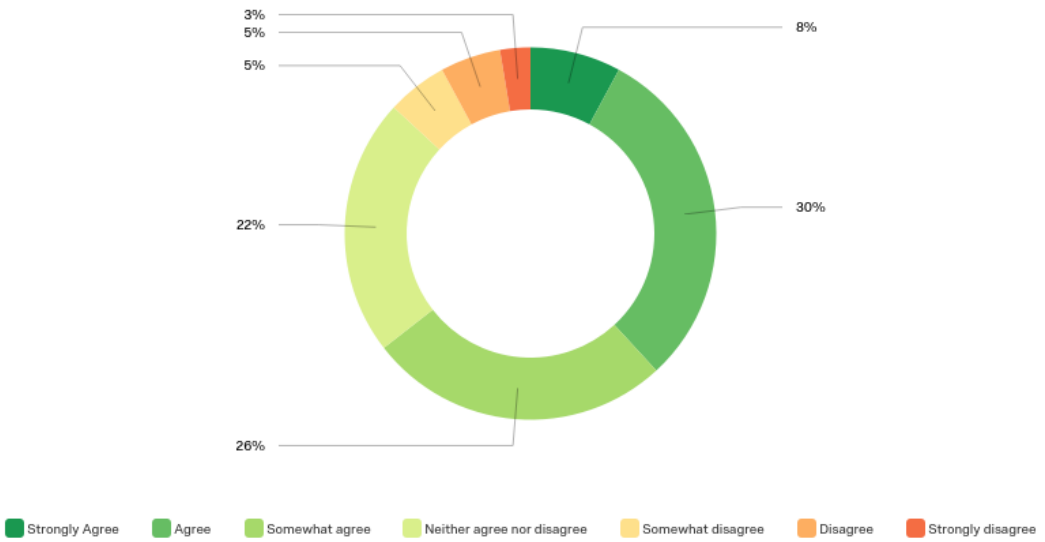
The active learning classroom provided my classmates and I with the opportunity to experience hands-on learning. I felt engaged during class, and was able to work on solving real, applied problems with a group of my peers. This classroom set up provided us with the opportunity to bounce ideas off of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

Colleen Plesac

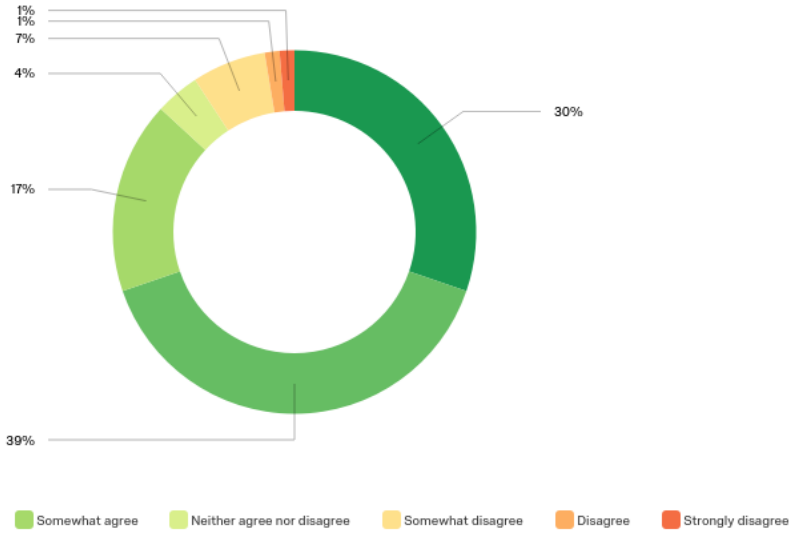
Biomedical Engineering

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



College of Engineering
Active Learning Initiative

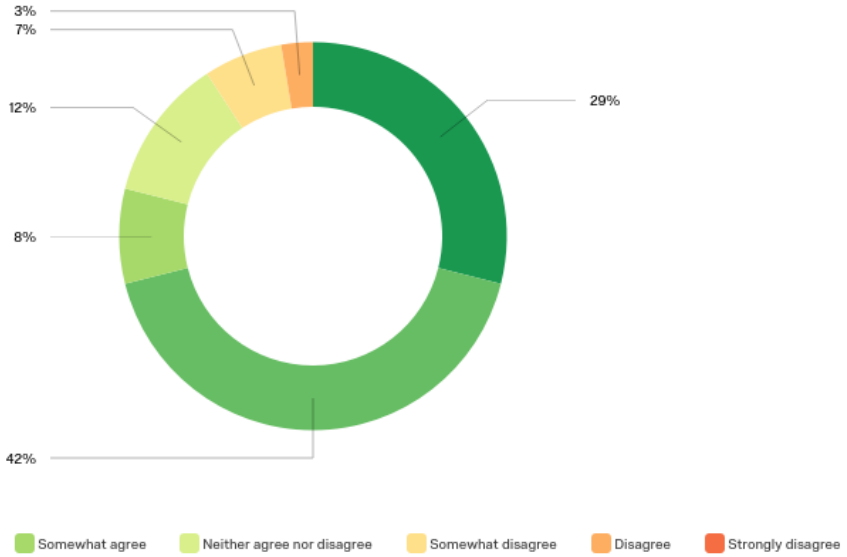
Statistical Quality Control and Quality Management was the first class I have taken in MEA 220, the interactive nature of the classroom was extremely helpful. The assignments given in class allowed us to practice our presentation skills. Being able to sit in our groups and work on activities together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

Jasmine Pattany

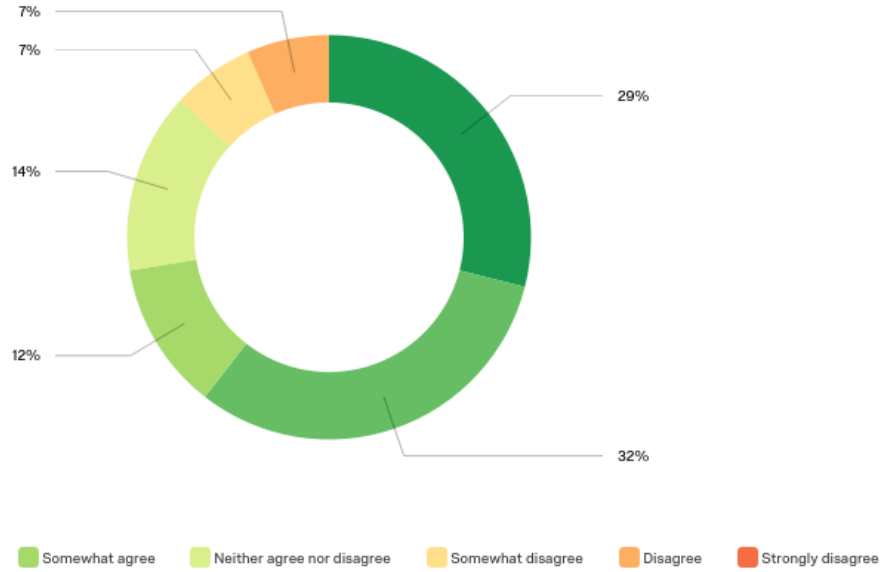
Industrial Engineering

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”



College of Engineering
Active Learning Initiative
Student Testimonials

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.

Michelle, Alex, Ebone, Jennill, Jessica, Rawan, & Maolin
Civil, Architectural and Environmental Engineering
Class of 2017

College of Engineering
Active Learning Initiative

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 than traditional lectures.

Jean-Pierre Bardet

Dean, College of Engineering

Thank you

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