The Flipped Classroom

Rima Bahous and Barbar Akle
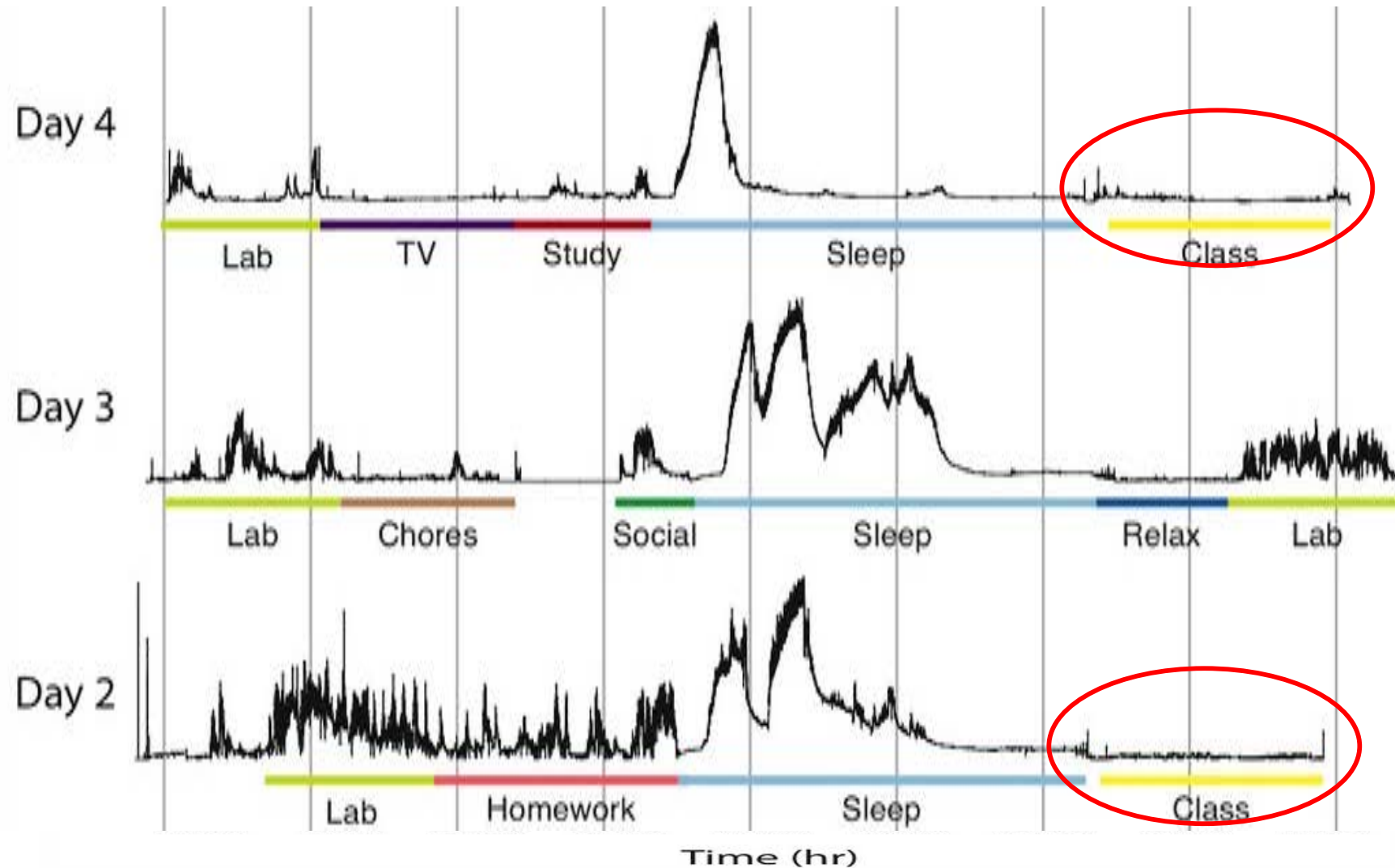
CIL Faculty Fellows Program - 2019

Outline

- What is the flipped classroom? (Rima)

- Advantages and Disadvantages (Rima)

- Designing a flipped classroom (Barbar)

- Engaging activities and class control (Barbar)

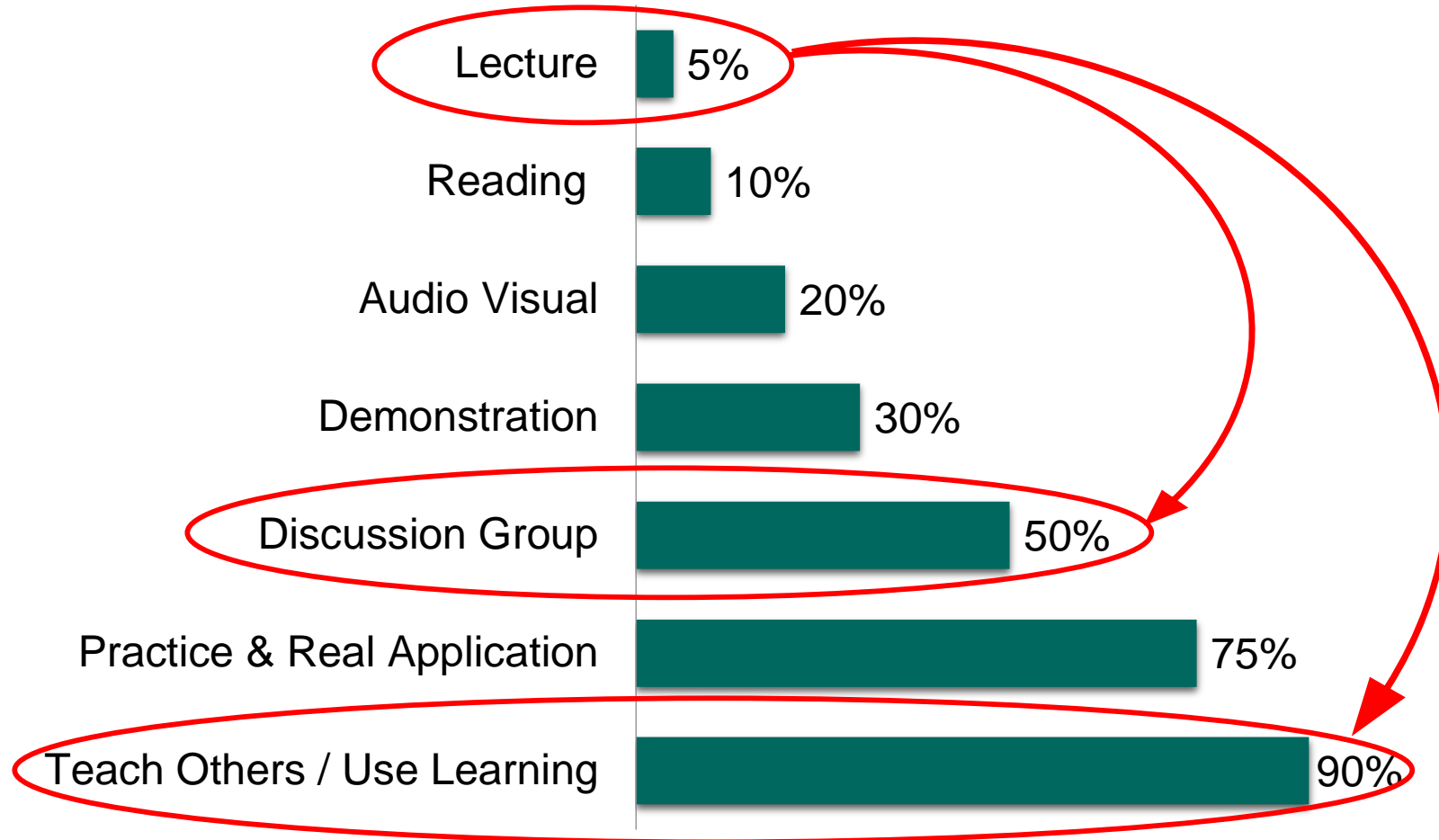- Assessment of the pedagogical method and lessons learned (Barbar)

Designing a flipped classroom

LAU
الجَامعَة اللبـنانيَة الأميركيَة
Lebanese American University

Teaching vs Active Learning

Knowledge Retention

Glaser, 2000; Bransford et. Al., 2007; Ragusa, 2013

Designing a flipped classroom

**Week 1: Topic: Introduction to fuzzy logic**

Learning Objectives:
1- Describe the Fuzzy Logic controllers
2- Design of fuzzification sets for linear system
3- Simulate the controller using Matlab

	Before Class	During Class	After Class
Activities	1. Watch the lectures. 2.Perform in movie quizzes. 3. Complete challenge x on Kahoot.	1. Formative Quizzes 2. Quick summary of lecture by students 3. Problem/case 4. Simulate the problem using Matlab	Implement in term project
Assessments	Collect Quiz and Kahoot data. Low percentage.	Collect Quiz data	1st component of the term project Two problems in midterm 1.

Bloom's Taxonomy

Before class →

During class →

After class →
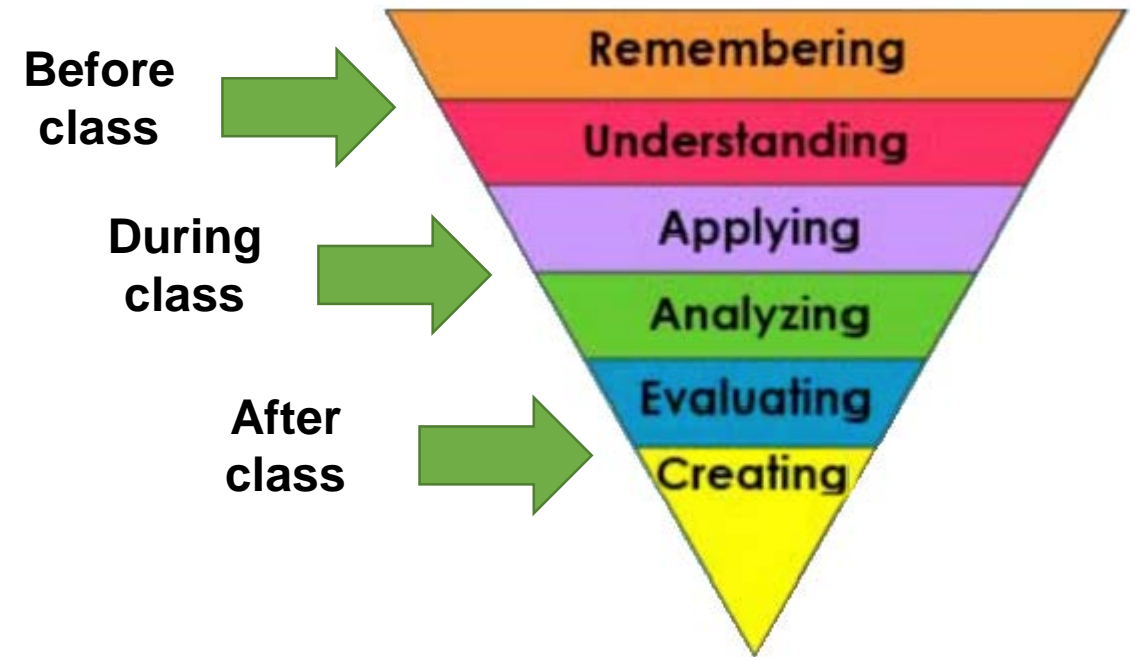
Goal: Teach my Students
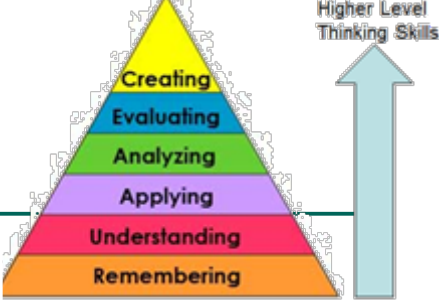
Interaction	Videos (Home)	Forums / wikis (Home)	F2F (Class)	Homework (Self/Peer)	Hands On (Lab/Project)
Listen / Read Take Notes	X	X			
Ask ?		X	X		
Practice (Examples & HW)			X	X	
Test Ideas			X	X	
Compare / Relate to Real World					X
Think ! & Build					X

- What LEVEL do I want to teach?
- What can my students do WITHOUT me ?
- What do I WANT them to do without me? (struggle vs. discover)
- I have 1 HOUR with my students. Where do I want it to be?

Engaging activities and class control

Pre-class Activities

Passive

- Videos you produce
- Videos from MOOCS
- Public Videos
- Pod-casts
- Reading text-books

Active

- Wikis / blogs / forums
- Quizzes
- Social Media

Class control

Are students responsible enough to complete the lectures and understand them before class?

- Imbed quizzes in the lecture movies
- Introduce HW/Challenges (low level)
- In class quizzes (first thing in the morning)
- Students briefly present the lecture at the beginning of the class

Ideas for active and engaged learning

- **Think-Pair-Share:** Ask an open ended question

- **One minute memo:** What are the two most important points from today's session?

- **Muddiest Point:** What is the muddiest point (least clear) from today's session?

- **Peer Instruction:** Present Course component

- **Peer Discussion**: Convince each other after a tricky quiz (poll)

- **Work together in groups:** Gallery Walk / Jigsaw

- **Case studies:** Apply course content to solve real world problems

- **Experiential Learning:** Demos/ simulations/ VR/ AR

- **Problem Based Learning**: students learn by working in groups to solve an open-ended problem

- **Role Playing:** Simulation of real-life scenarios

- **Game-Based Learning:** Turn a certain aspect of the learning into a game

Kahoot Demo

Available Student Response Systems:

- Clickers: Avaialble hardware, may be integrated in presentation, etc..

- Kahoot: use mobile phones, gamification, etc..

- Many others are available for free or license

# Assessment of the pedagogical method and lessons learned

Effect of Flipping an Engineering Course on Student Performance: a comparison to Traditional and Blended Learning

Barbar J. Akle, and George E Nasr., Senior Member, IEEE
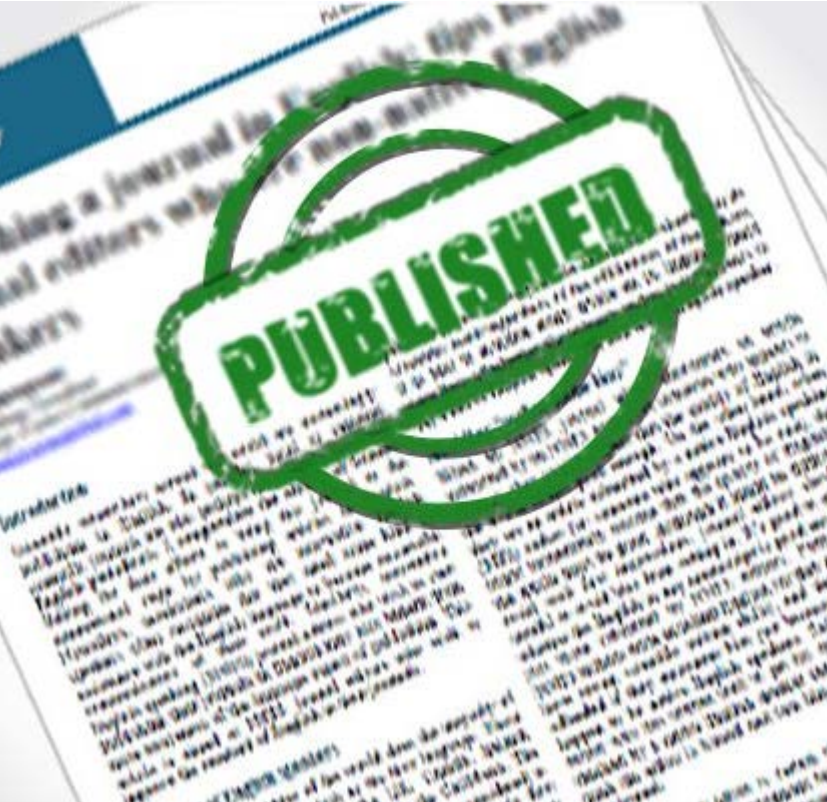
Methodology

- Study took place in two sections of the "Control Systems" course for Mechanical Engineering Students at LAU

  - Traditional Classroom (TC)
    - Schedule: 1:00pm-1:50pm MWF
    - 44 students
    - Average GPA = 2.89

  - Flipped Classroom
    - Schedule: 10:00am-10:50am MWF
    - 34 students
    - Average GPA = 2.84
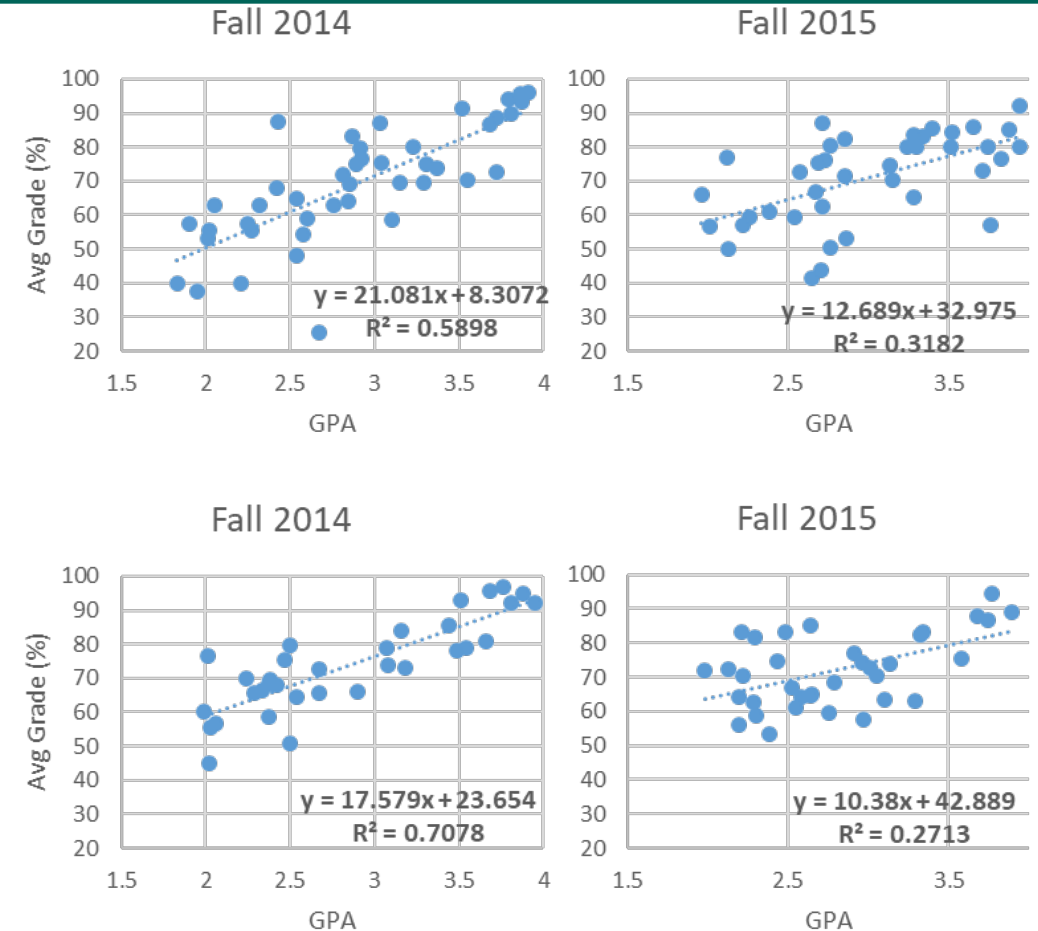
Scatter plot of the GPA of students versus the average grade on exams in (a) Year 1(Fall 2014)traditional section, (b) Year 1(Fall 2014)flipped section, (c) Year 2(Fall 2015)blended section and (d) Year 2 (Fall 2015) flipped section.

Methodology – Delivery of the Traditional Classroom

- PowerPoint guided lectures: 75% of the class-time

- text-book like problem solving: 20% of the class-time

- MATLAB tutorial/simulations: 5% of the class-time

- Pop quizzes: ~one each two weeks

- Text-book homework assignments once per weeks

- Grade distribution: quizzes (5%), Exam 1 and Exam 2 (55%) and a Final Exam (40%)

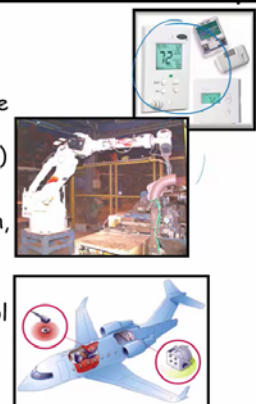# Methodology – Delivery of the Flipped Classroom

- 20 minutes long video per session usually split into two movies

- Most sessions started with a 5min review, frequently followed by a quiz.

- Remaining class-time was filled with:
  - problem solving
  - MATLAB simulations
  - group-work case studies
  - group-work design problems

- Text-book homework assignments once per weeks

- Grade distribution: quizzes (10%), Exam 1 and Exam 2 (55%) and a Final Exam (35%)

Results – Instructor Feedback

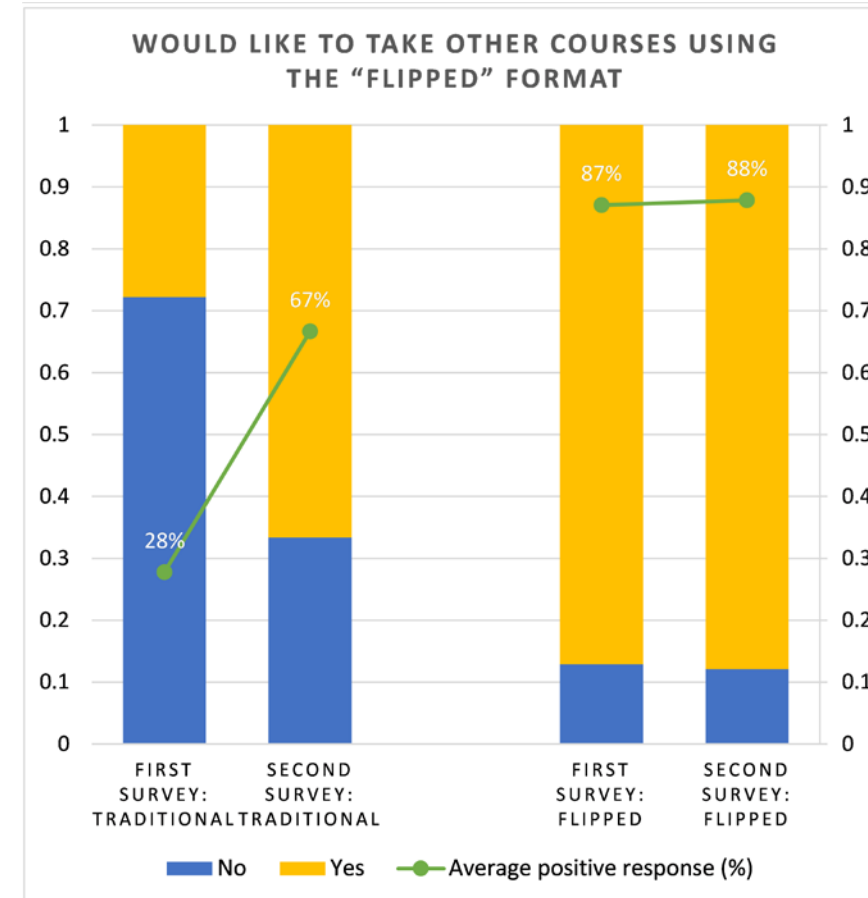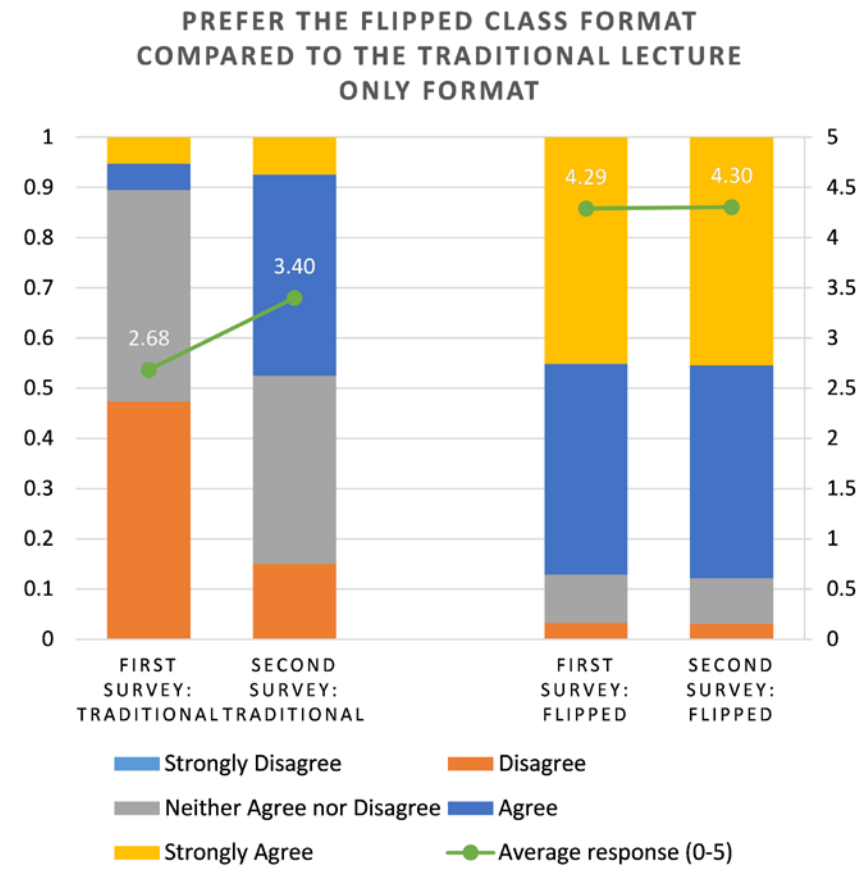| Traditional Classroom	Flipped Classroom
2 Matlab half sessions	6 Matlab sessions
6 quizzes	20+ quizzes
	More student-faculty interaction and better engagement
	More discussions and examples
	Much more in class problem solving
	Direct feedback on student performance
More student preparation time	
Much more faculty preparation time (especially first time)	

Statistical Assessment

	Traditional (2014)	Flipped (2014)	Difference	Blended (2015)	Flipped (2015)	Difference
	20.35	20.67	0.32	20.51	20.57	0.06
Age	(1.16)	(1.20)		(1.28)	(0.99)	
	43	33		39	35	
	0.14	0.15	0.01	0.15	0.11	0.04
Gender (female =1)	(0.35)	(0.36)		(0.36)	(0.32)	
	43	33		39	35	
Number of Credits completed	88.44	101.27	12.83	92.28	93.57	1.29
	(19.78)	(18.85)		(24.87)	(23.72)	
	43	33		39	35	
	2.89	2.85	0.05	2.99	2.80	0.19
GPA	(0.61)	(0.63)		(0.57)	(0.52)	
	43	33		39	35	
Average Grade (%)	69.29	73.71	4.42	70.96	71.94	0.98
	(16.75)	(13.19)		(12.89)	(10.43)	
	43	33		39	35	

Student Performance

		Academic year 2014-2015			Academic year 2015-2016	
		Flipped	Traditional		Flipped	Blended
Exam 1	Count	33	43		35	39
	Minimum	30	17		37	17
	Average	61.62	58.23		67.1	67.0
	Maximum	93	90		98	94
	Stdev	18.12	18.01		15.3	17.8
Exam 2	Count	33	43		35	39
	Minimum	60	30		49.5	24
	Average	85.27	79.98		76.8	74.8
	Maximum	105	105		96	96
	Stdev	10.67	18.02		12.3	17.5

Bar chart — Grade (%) vs year. Predicted (blue) and Actual (red).
2014: Predicted 68.34, Actual 73.71. 2015: Predicted 68.48, Actual 71.94.
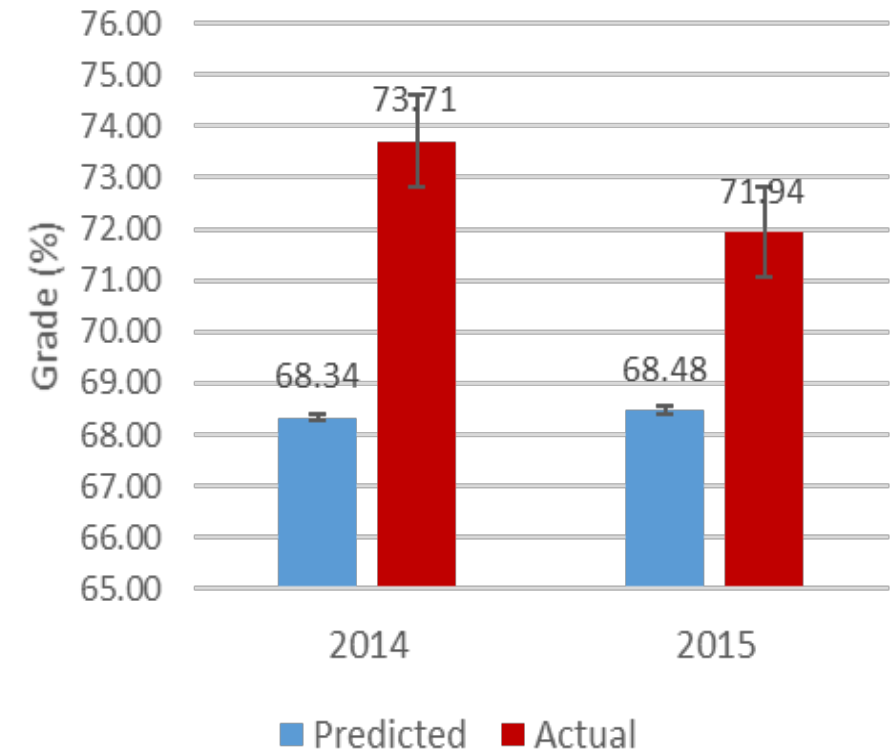
Results – Surveys 1

Results – Surveys II
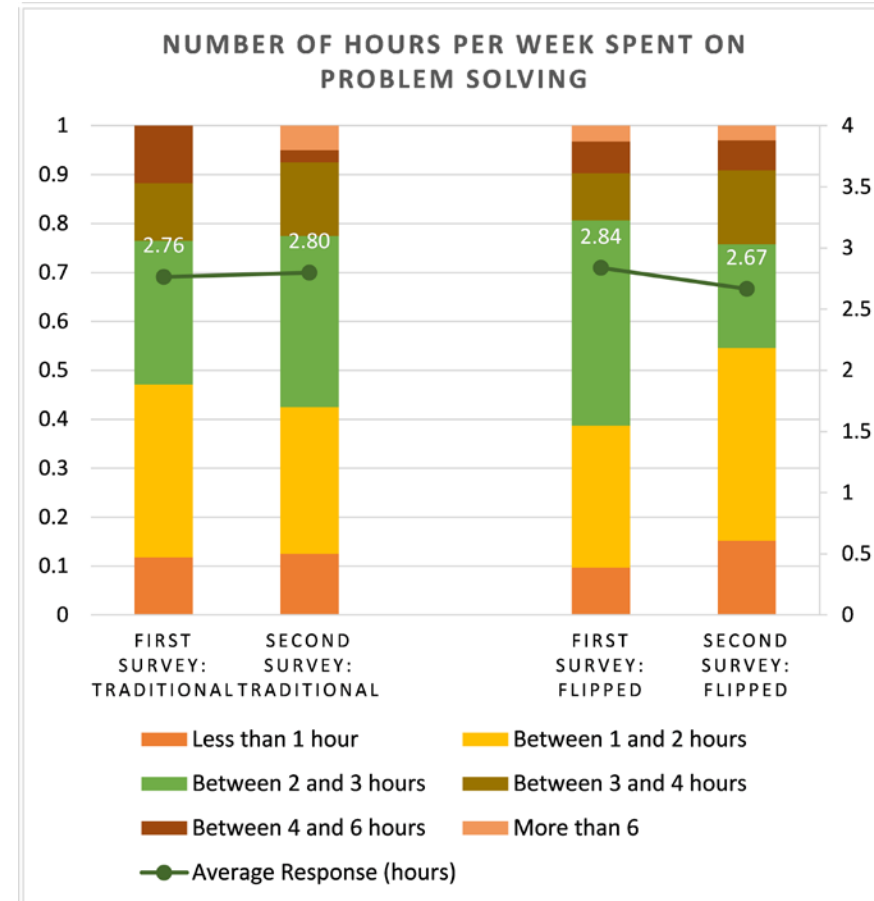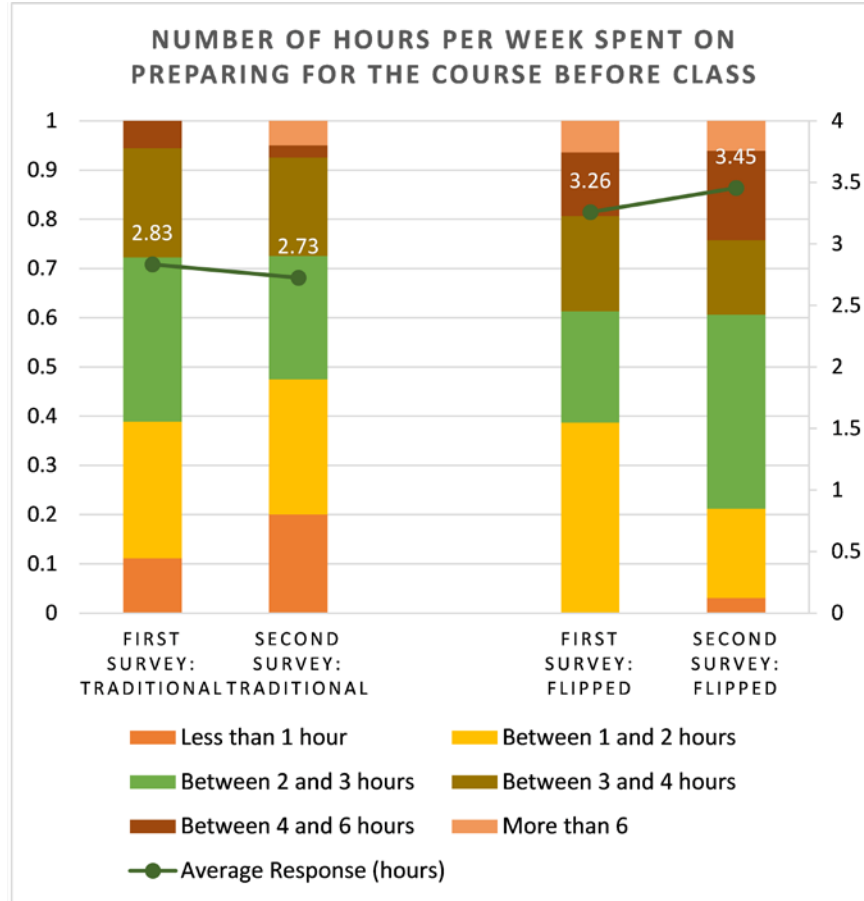
Conclusions

- Flipped Classroom improved student average in a senior engineering course

- It improved student engagement and allowed time for more in-depth discussions and room to add more material if needed

- Students enjoyed the experience and demanded implementing it in other courses

- Flipped classroom requires a lot of preparations for both faculty (especially the first time) and students

Thank You