



# Monitoring and supporting persistence to STEM degrees

(Examples from the Innovation and analytics trenches)

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## Maximize UCD graduates' **Capability + Resilience → CAREER** through **EVIDENCE-BASED ACTION**

### Strategy 1

**Catalyze cultural change**

[institution & policy]

**Develop communities**

[support/sustain change]

### Strategy 2

**Catalyze/Test innovations**

**i**nstruction  
**a**sessment  
**C**urriculum  
**e**xperiences  
**(iACE)**

### Strategy 3

**Build and share**  
**analytics tools & architecture**  
to measure and inform  
**improvement**  
of student outcomes and  
teaching practices



# PATTERNS & SOLUTIONS?



STEM & Non-STEM **LOSS** – URG, First Generation, Low Income

**GPA patterns** – STEM stayers and leavers, URG

SPECIFIC STEM MAJOR **PATHS**

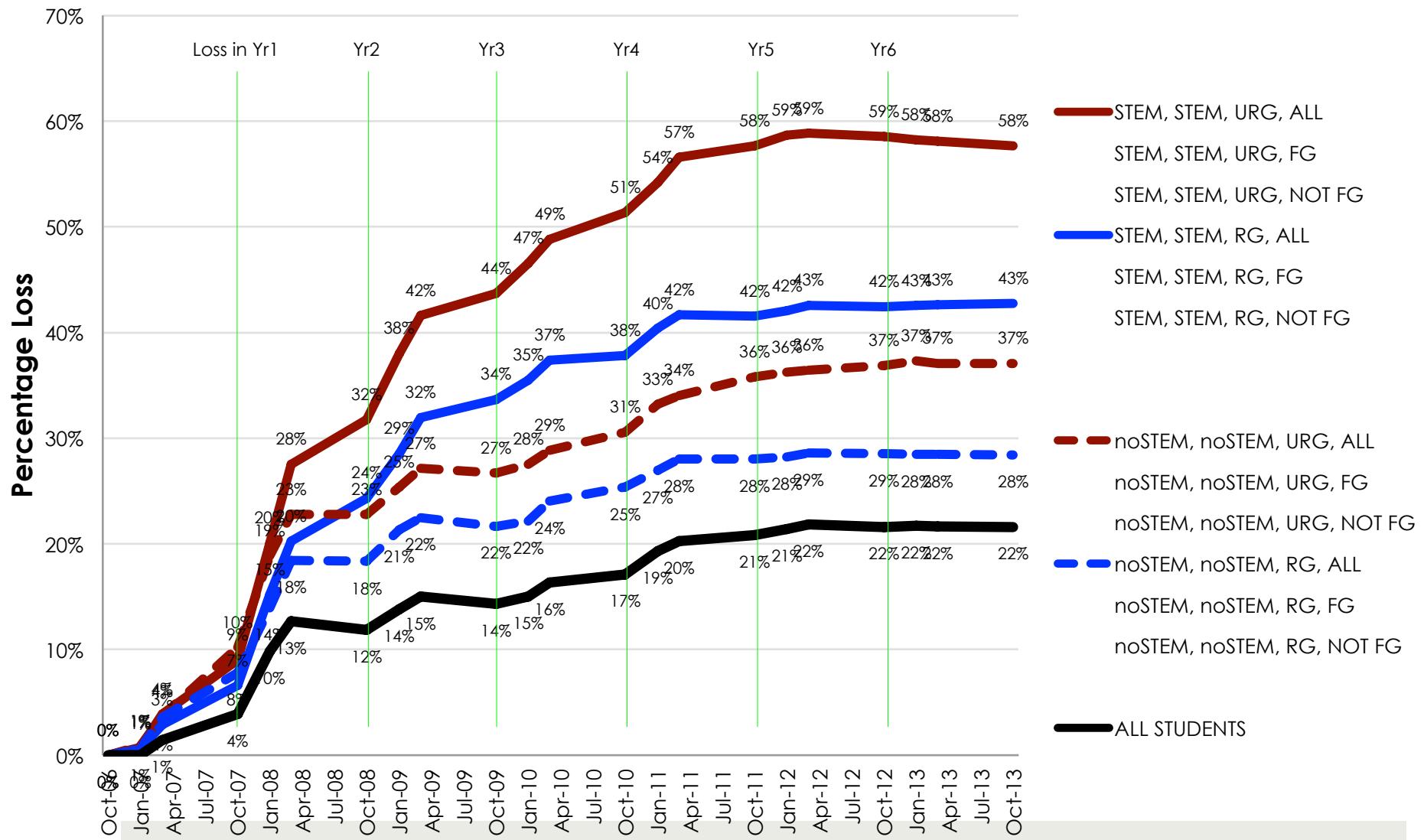
**EMBRACING WHOLE SYSTEM-** PLACEMENT, GRADING,  
INSTRUCTION

A **HOLISTIC APPROACH** towards improvement

# STEM VS Non-STEM Losses



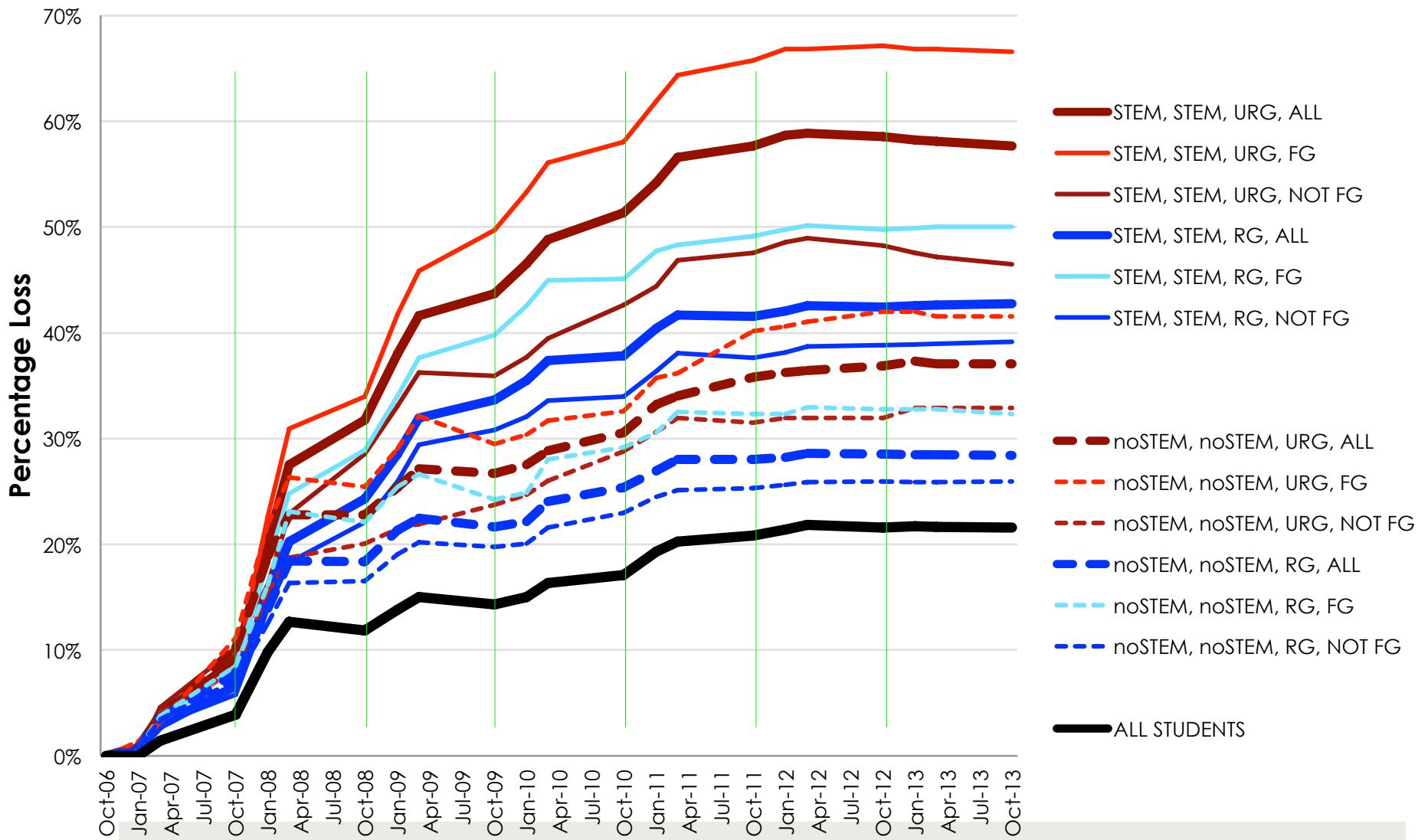
Percentage Loss of Students from Graduation by Term (Fall 2006 entering class)



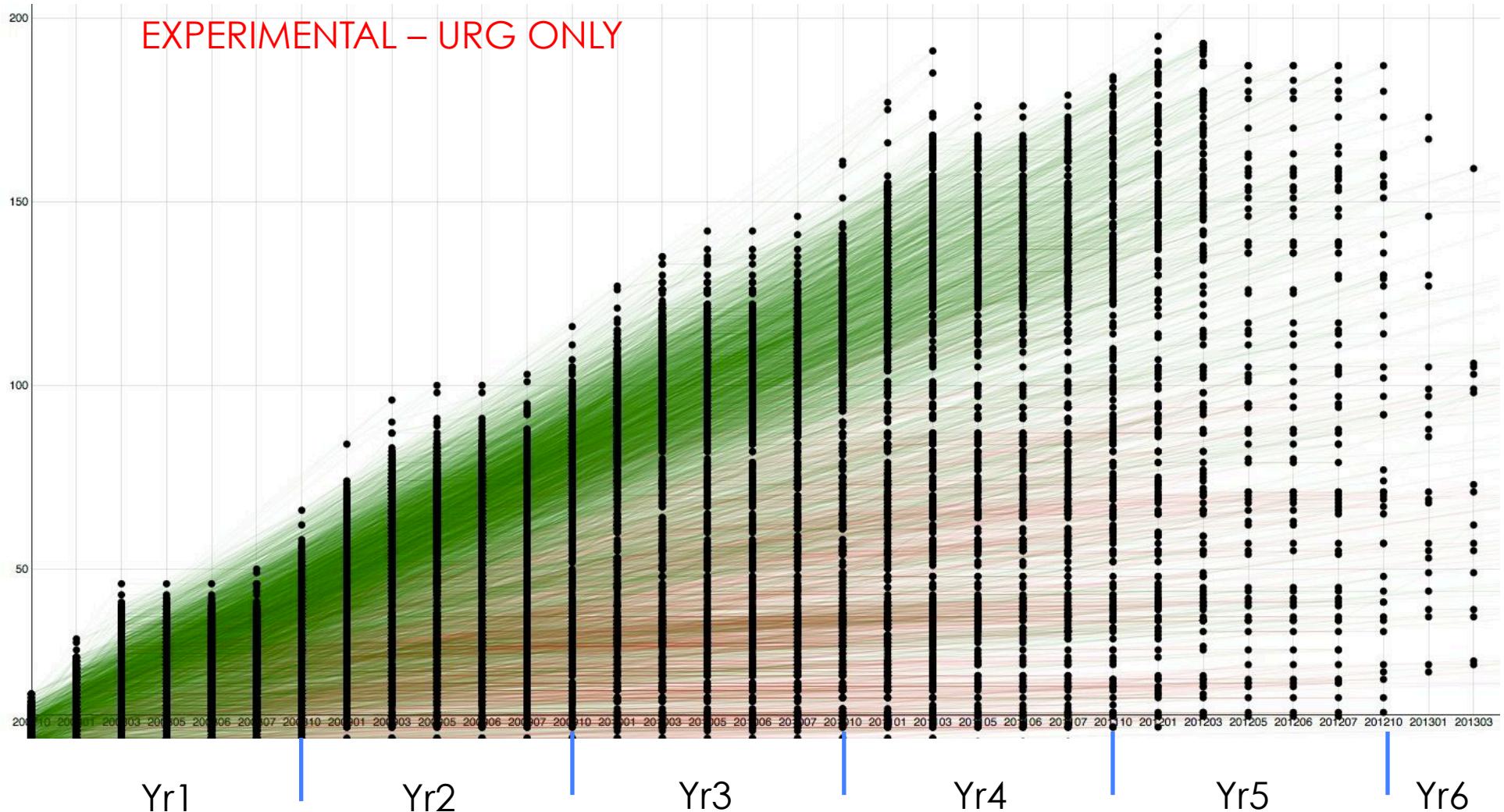
# Impact of First Generation



## Percentage Loss of Students to Graduation by Term (Fall 2006 entering class)

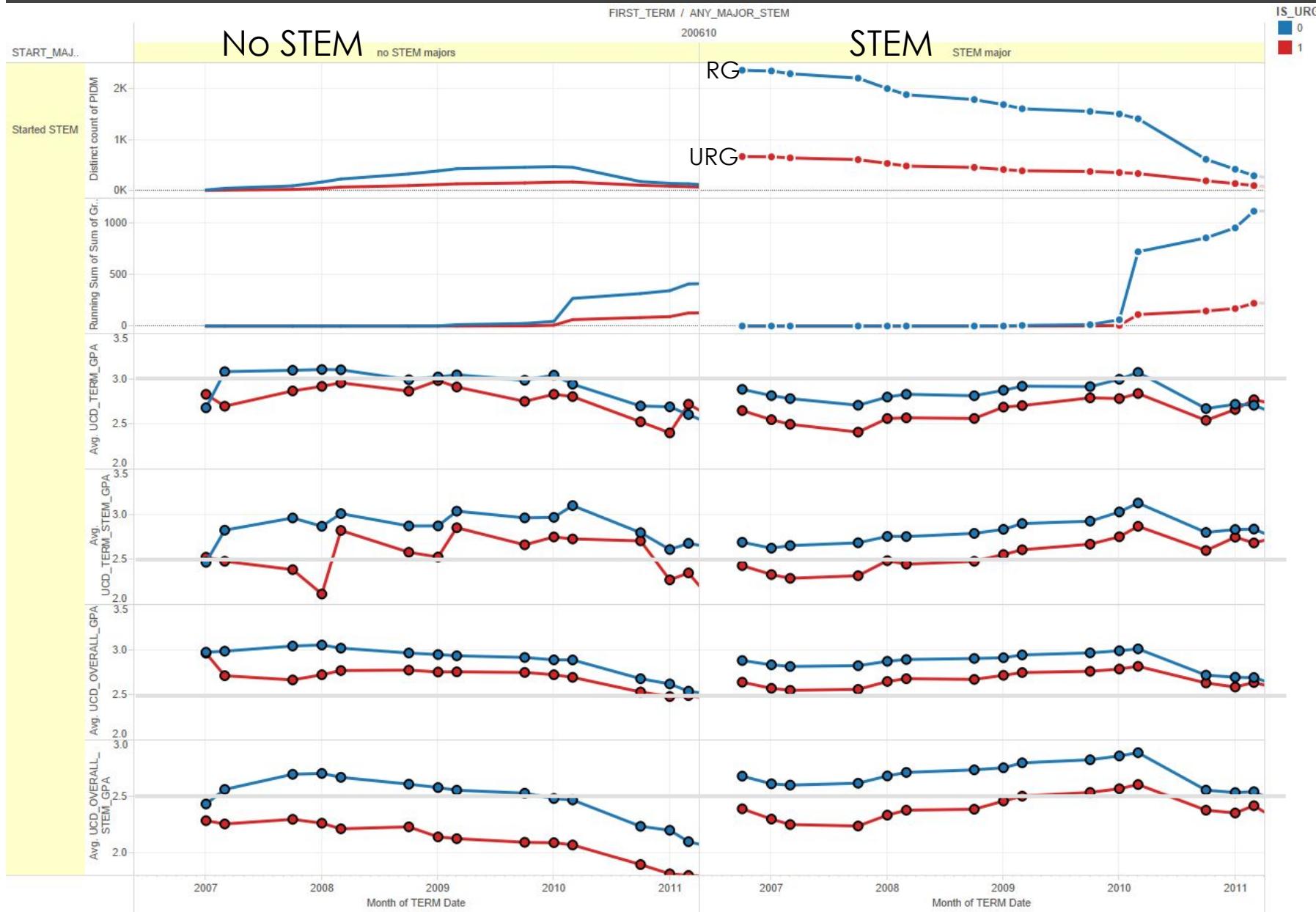


# When do they really leave?



# GPA and URG status –STEM start

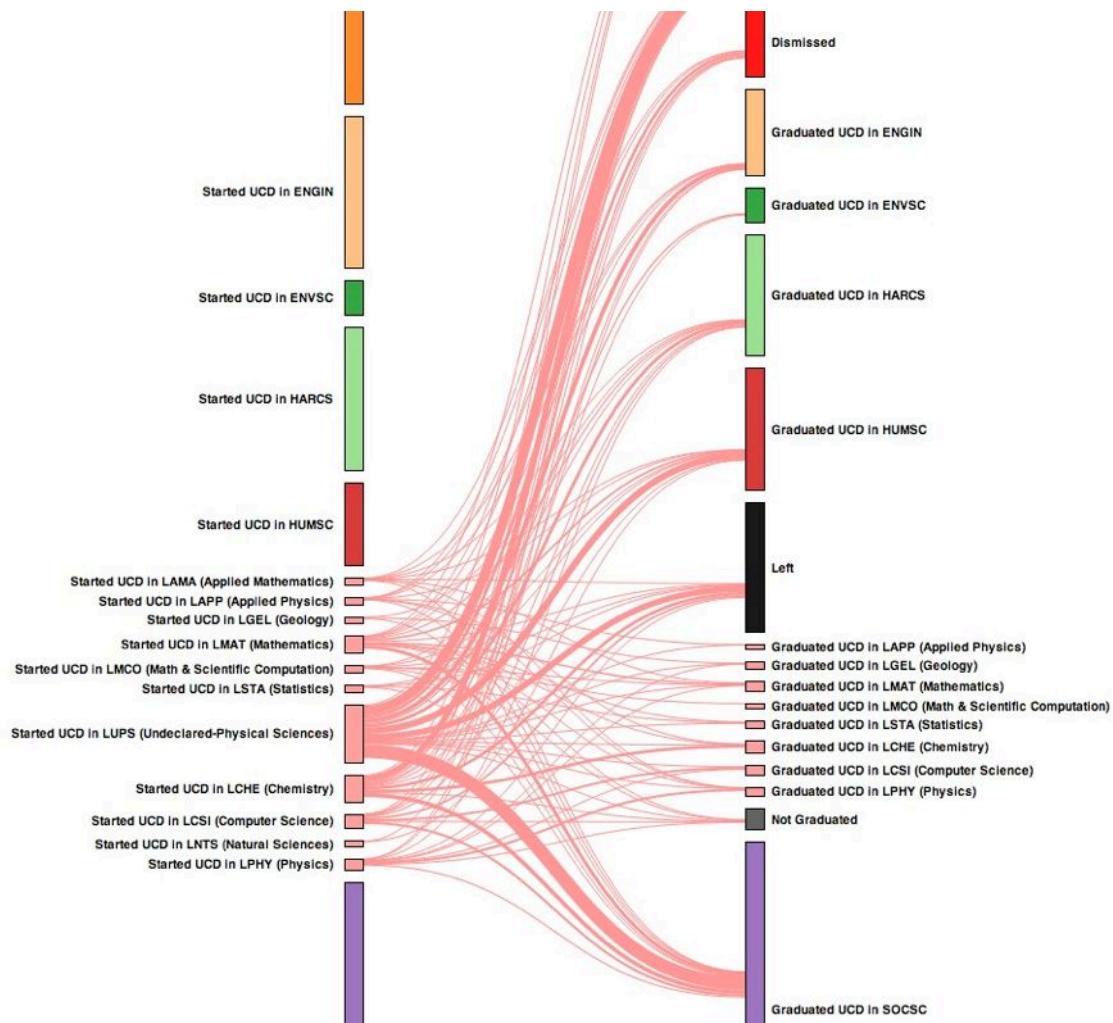
UCDAVIS  
iAMSTEM  
HUB



# PATHS: Major in/Major out

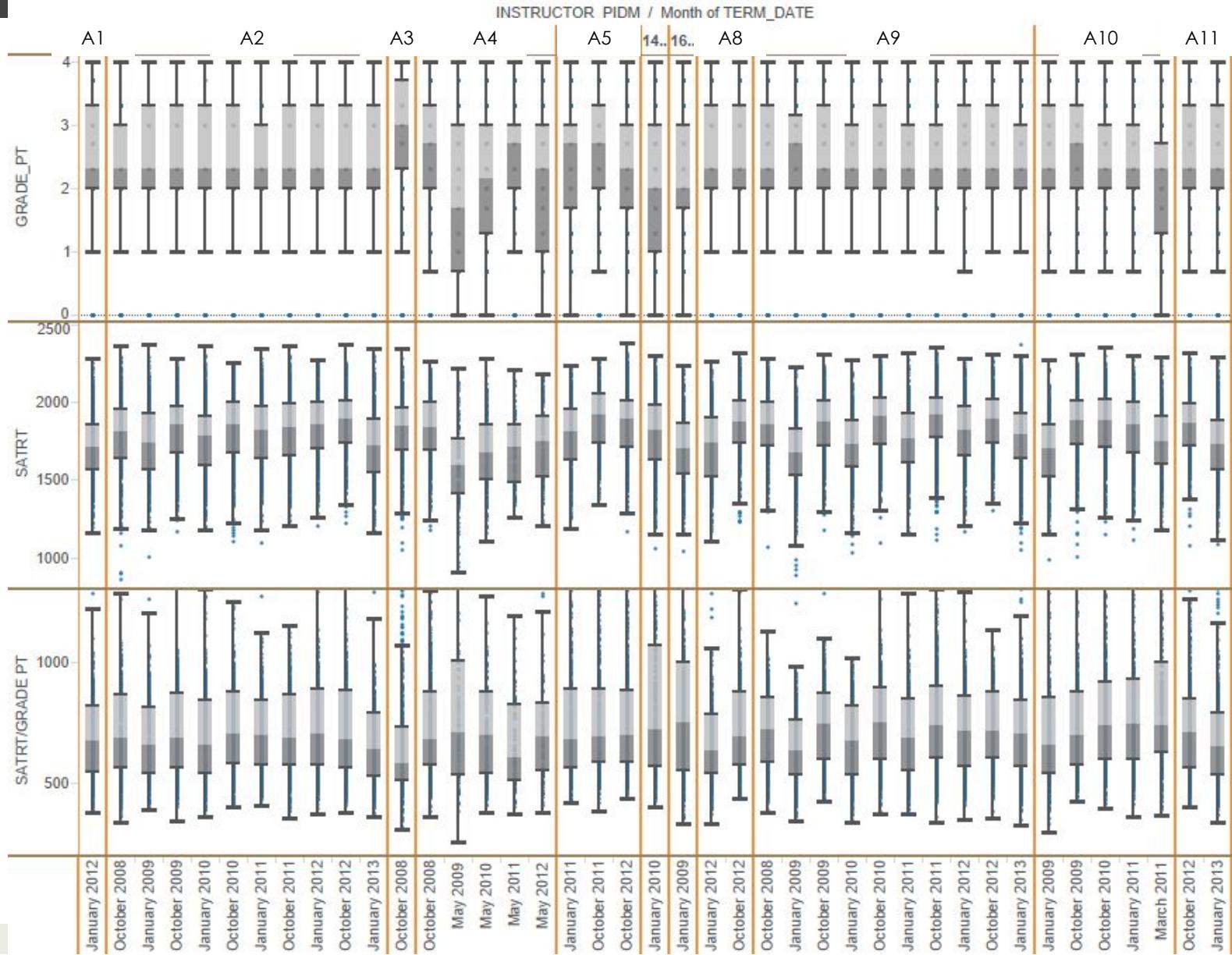


## Fall 2006 Student Flows from Math and Phys Science to Graduation



# SYSTEM: Instruction

GRADE  
PT

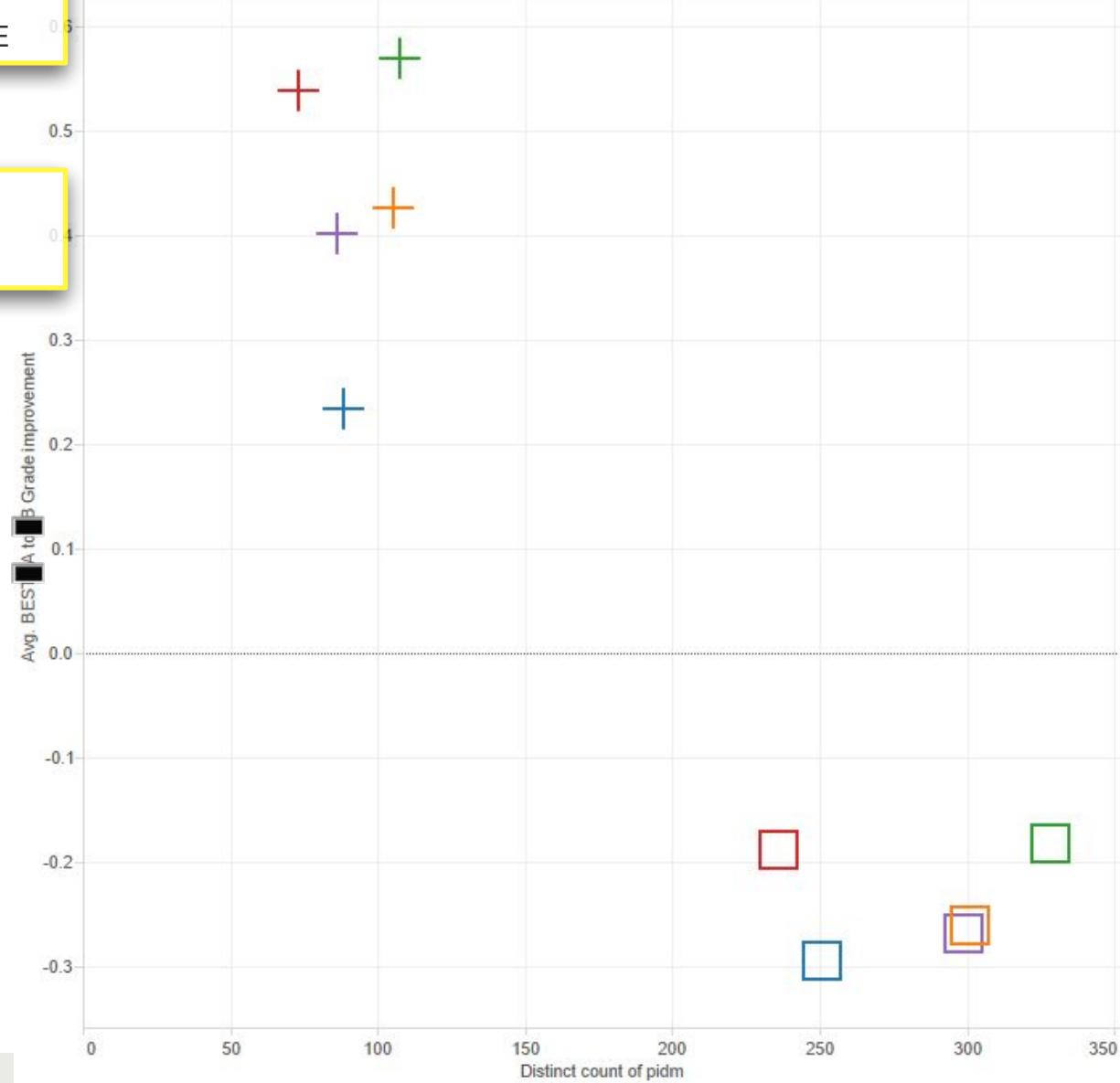


# Instructor/Student Outcomes



## SUBSEQUENT COURSE PERFORMANCE

## INSTRUCTOR VARIATION



2012 Fall  
A

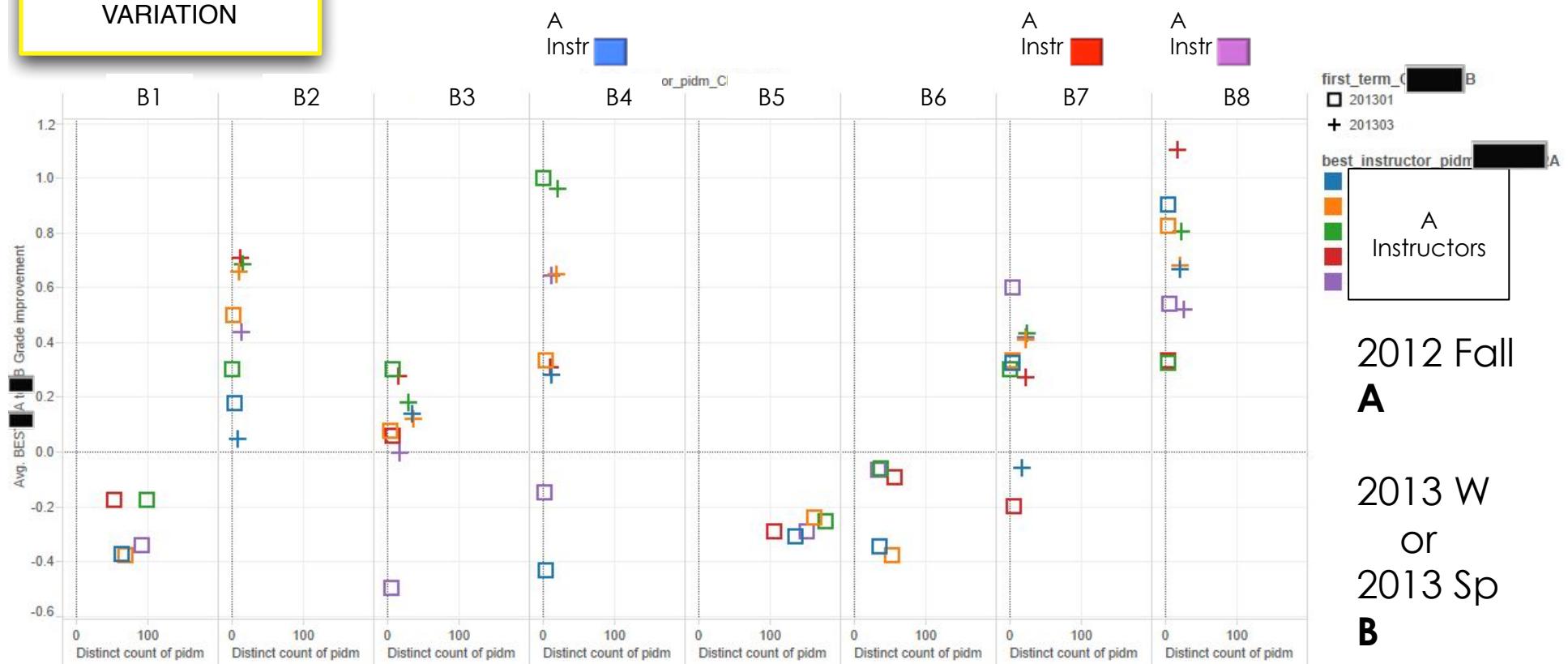
2013 W  
or  
2013 Sp  
**B**

# Instructor/Student Outcomes



SUBSEQUENT  
COURSE  
PERFORMANCE

INSTRUCTOR  
VARIATION



HOLISTIC APPROACH



**PRE/POST** CONTENT

**PRE/POST** Attitude

CLASSROOM **OBSERVATIONS & PRACTICE**

STUDENT **FEEDBACK**

ENCOURAGE **EVIDENCE-BASED** Practices



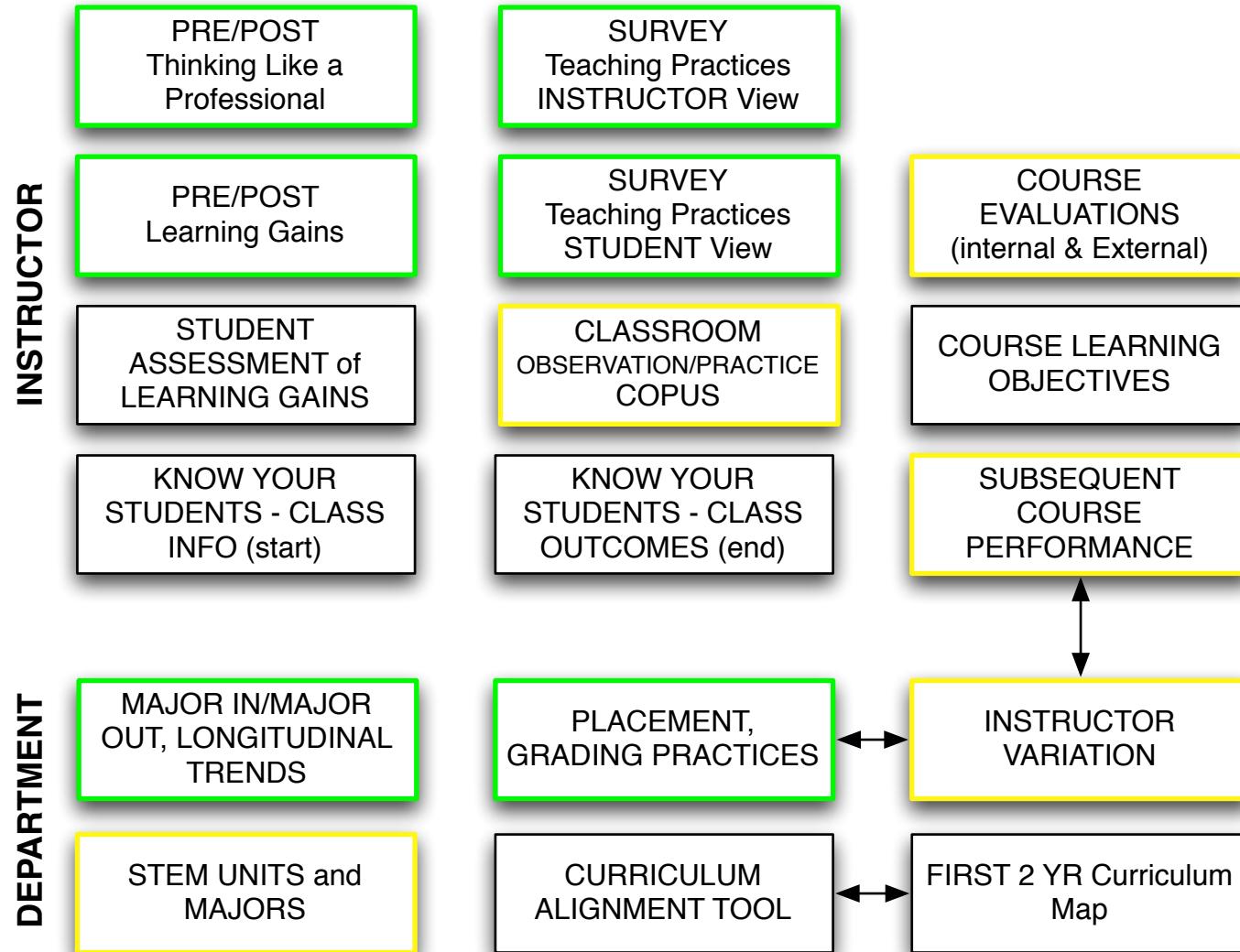
**BAY VIEW  
ALLIANCE**



# USER: Instructor/Department



Faculty  
Lecturers  
Pdocs  
Grad. Students



# USER: Student/University Overall



STUDENT

ADAPTIVE COURSE-  
LEVEL Dashboard

EARLY WARNING  
SYSTEMS

LEARNING  
MANAGEMENT  
SYSTEM

ADMINISTRATIVE  
FUNCTIONS

ADVISING &  
SUPPORT

UNIVERSITY

LONGITUDINAL  
STUDENT  
OUTCOMES post-grad

LOCALIZED  
INSTITUTIONAL  
METRICS (current,  
change) teaching  
practice, learning gains,  
retention,...

PREDICTIVE  
ANALYTICS -  
ADVISING

PREDICTIVE  
ANALYTICS -  
RESOURCES

# PRE/POST Example: Content



## BIOLOGY (Preliminary results)

average # of questions answered correctly on Pre-Post :

### **Total students**

Before: 13/26

4 point (15% gain)

After: 17/26

### **Top Quartile students**

Before: 18/26

After: 19/26

### **Bottom Quartile students**

Before: 8/26

4 point (30% gain)

After: 15/26

# PRE/POST Example: Attitudes

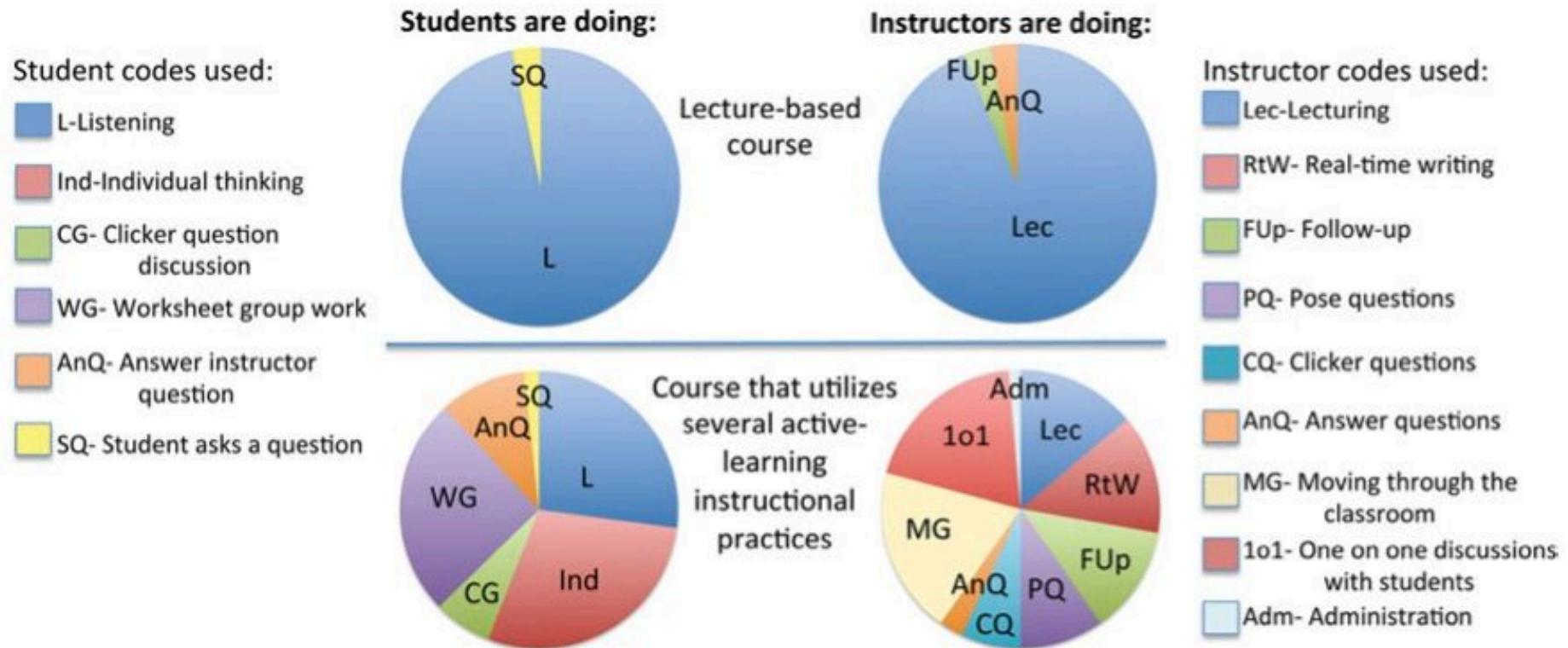


	Class A			Class B			Time X Group Interaction p-Value
	Pre	Post	Change	Pre	Post	Change	
Overall	63.4	60.9	-2.5	63.4	58.9	-4.5	.075
<b>Real World Connections</b>	<b>71.4</b>	<b>70.6</b>	<b>-0.8</b>	<b>73.7</b>	<b>68.0</b>	<b>-5.7</b>	<b>.010*</b>
Problem-Solving Difficulty	49.1	47.1	-2.0	48.5	45.6	-2.9	.618
<b>Enjoyment</b>	<b>59.6</b>	<b>59.9</b>	<b>0.3</b>	<b>60.2</b>	<b>56.1</b>	<b>-4.1</b>	<b>.023*</b>
<b>Problem-Solving Effort</b>	<b>64.2</b>	<b>64.0</b>	<b>-0.2</b>	<b>66.1</b>	<b>61.2</b>	<b>-4.9</b>	<b>.012*</b>
Conceptual Connections/Memorization	68.3	65.0	-3.3	69.5	64.0	-5.5	.203
<b>Problem-Solving Strategies</b>	<b>67.0</b>	<b>69.6</b>	<b>2.6</b>	<b>68.1</b>	<b>65.9</b>	<b>-2.2</b>	<b>.042*</b>
Reasoning	76.8	73.5	-3.3	78.3	73.1	-5.2	.384

Note: A statistically significant Time X Group Interaction indicates that the amount Class A and Class B changed from pre to post was significantly different.

CLASS BIO instrument from Boulder

# Classroom Observation(COPUS)



**Figure 4.** A comparison of COPUS results from two courses that have different instructional approaches.

Based on 2-minute increment observations

The Classroom Observation Protocol for Undergraduate STEM (COPUS): A New Instrument to Characterize University STEM Classroom Practices  
 Michelle K. Smith,\* Francis H. M. Jones,† Sarah L. Gilbert,‡ and Carl E. Wieman‡  
 CBE—Life Sciences Education Vol. 12, 618–627, Winter 2013

# Student Feedback



## ***Highly Structured Course***

Adaptive Learning Modules [Carnegie Mellon OLI]

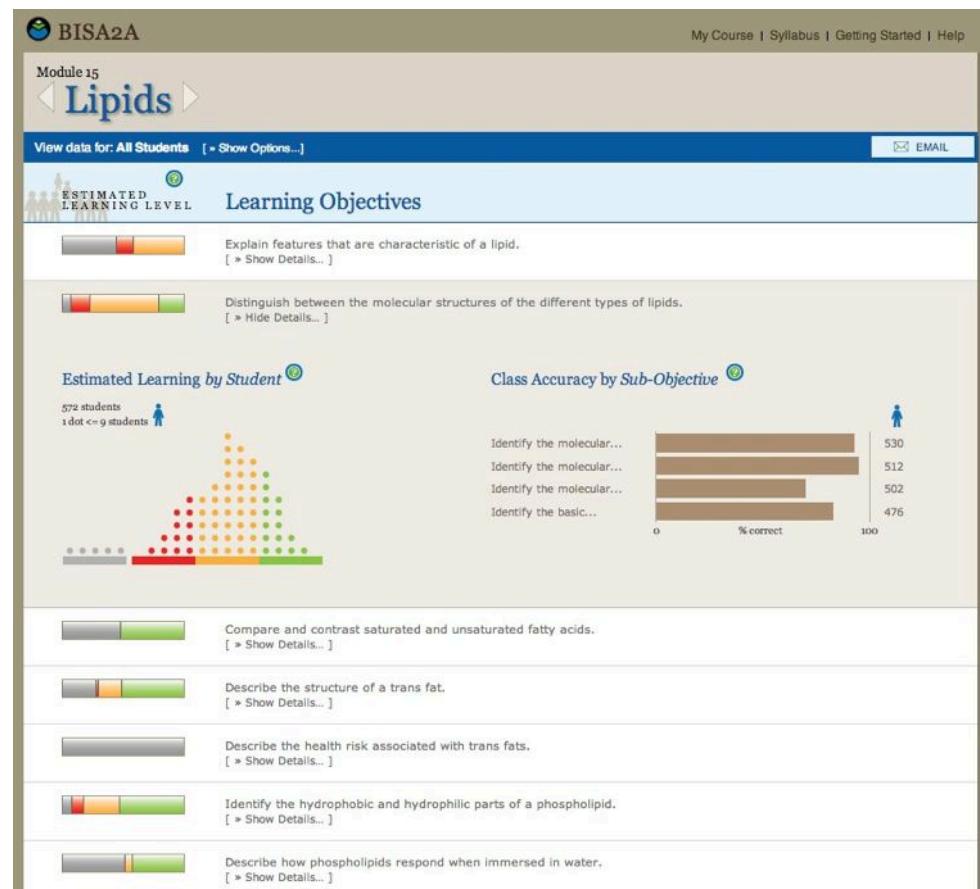
Flipped Classroom [UW Bio Group]

In-class group exercises

Practice exams, Reading quizzes

**EXPECTED (hoped for)** reduction in achievement gap

**~45%**





# THANK YOU!!

# QUESTIONS?



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