

# Launching a Peer Supplemental Instruction (**PSI**) Program for STEM majors

By

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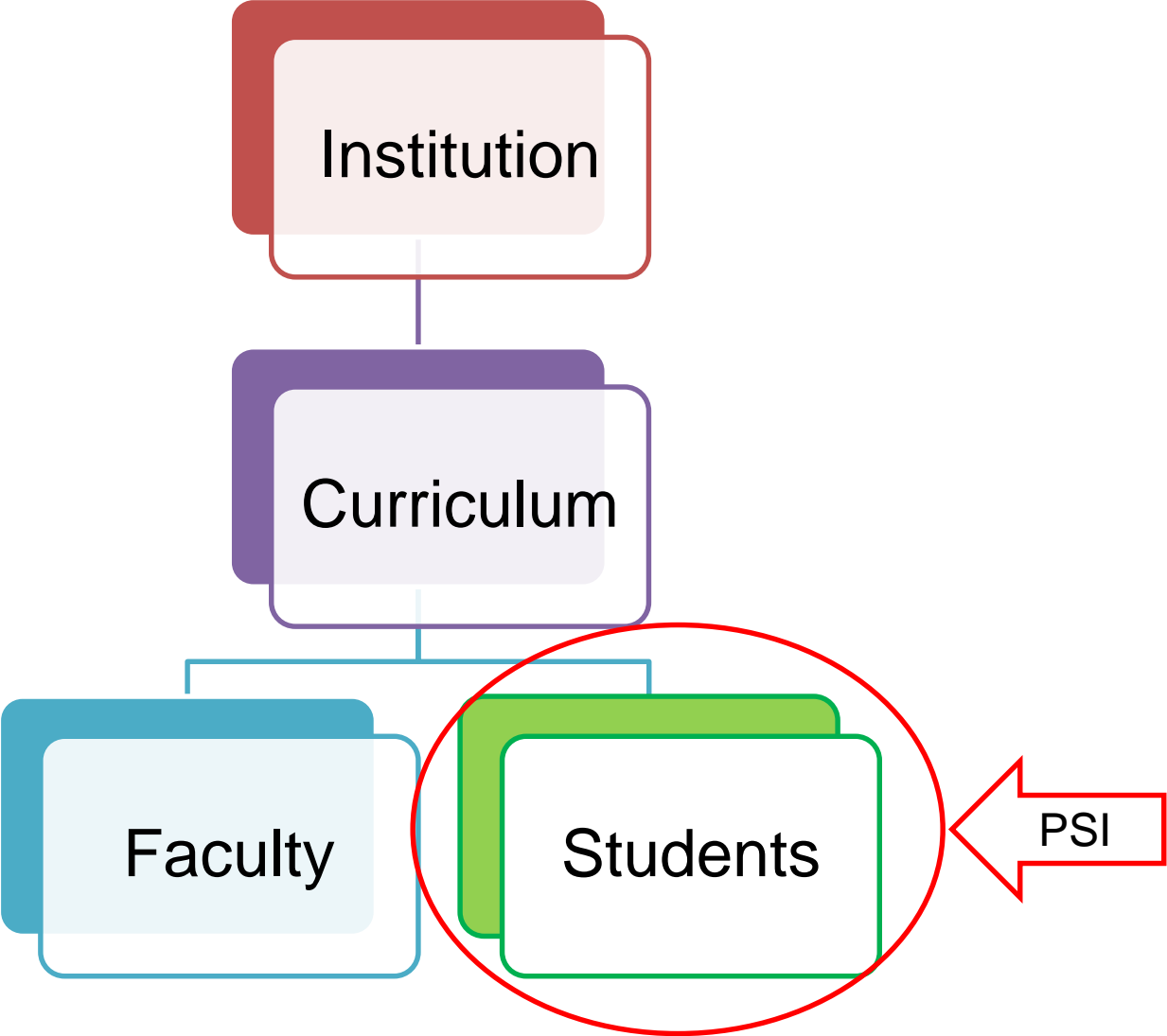
University System of Georgia STEM Summit  
Middle Georgia State University  
May, 2017



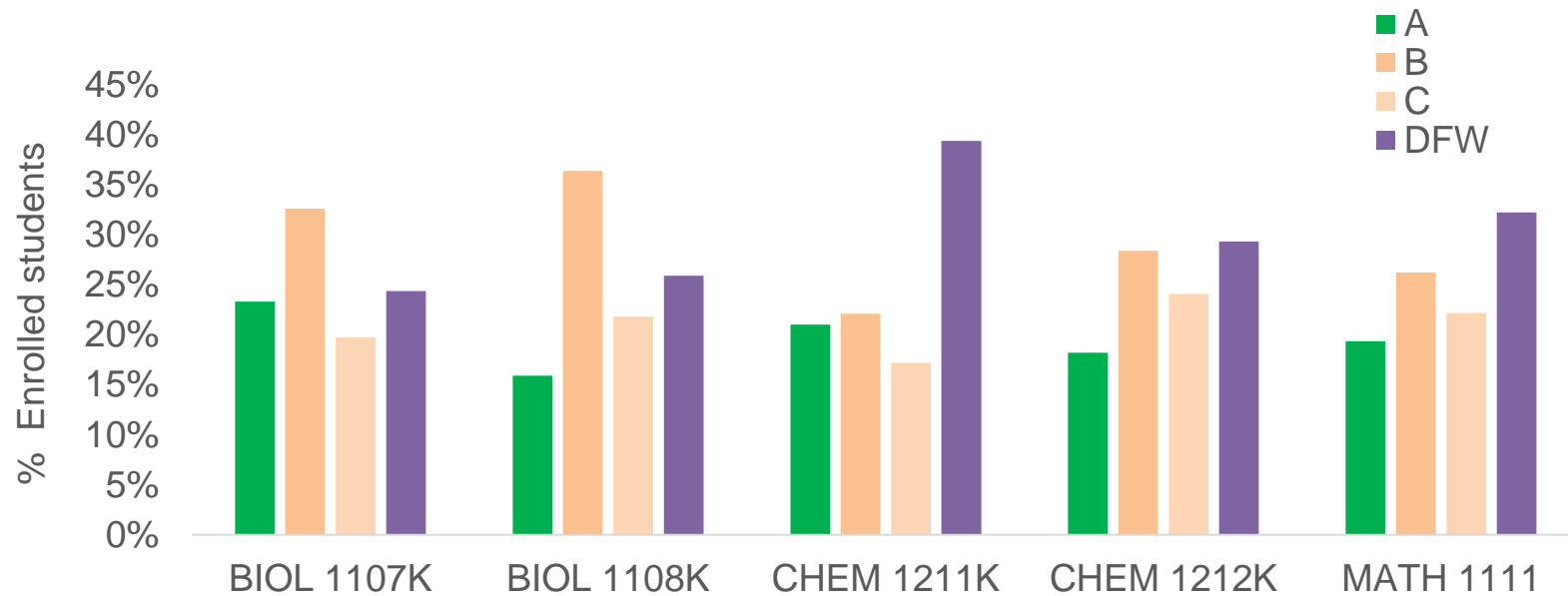
# Presentation Agenda

- Introduction:
  - Inspiration and need for PSI
  - PSI Program objectives
  - Evolution of PSI at Georgia Gwinnett College
- Methods:
  - Unique adaptations for Georgia Gwinnett College
  - Leaders, training, sessions (2015-2017)
- Outcomes:
  - Impact of PSI on students and leaders
  - Incentive study
- Future directions:
  - Research questions
  - Enhancing the model

# GGC's Systems Approach Framework For Achieving Student Retention and Graduation



# Grade distribution for BIOL, CHEM, MATH gateway courses



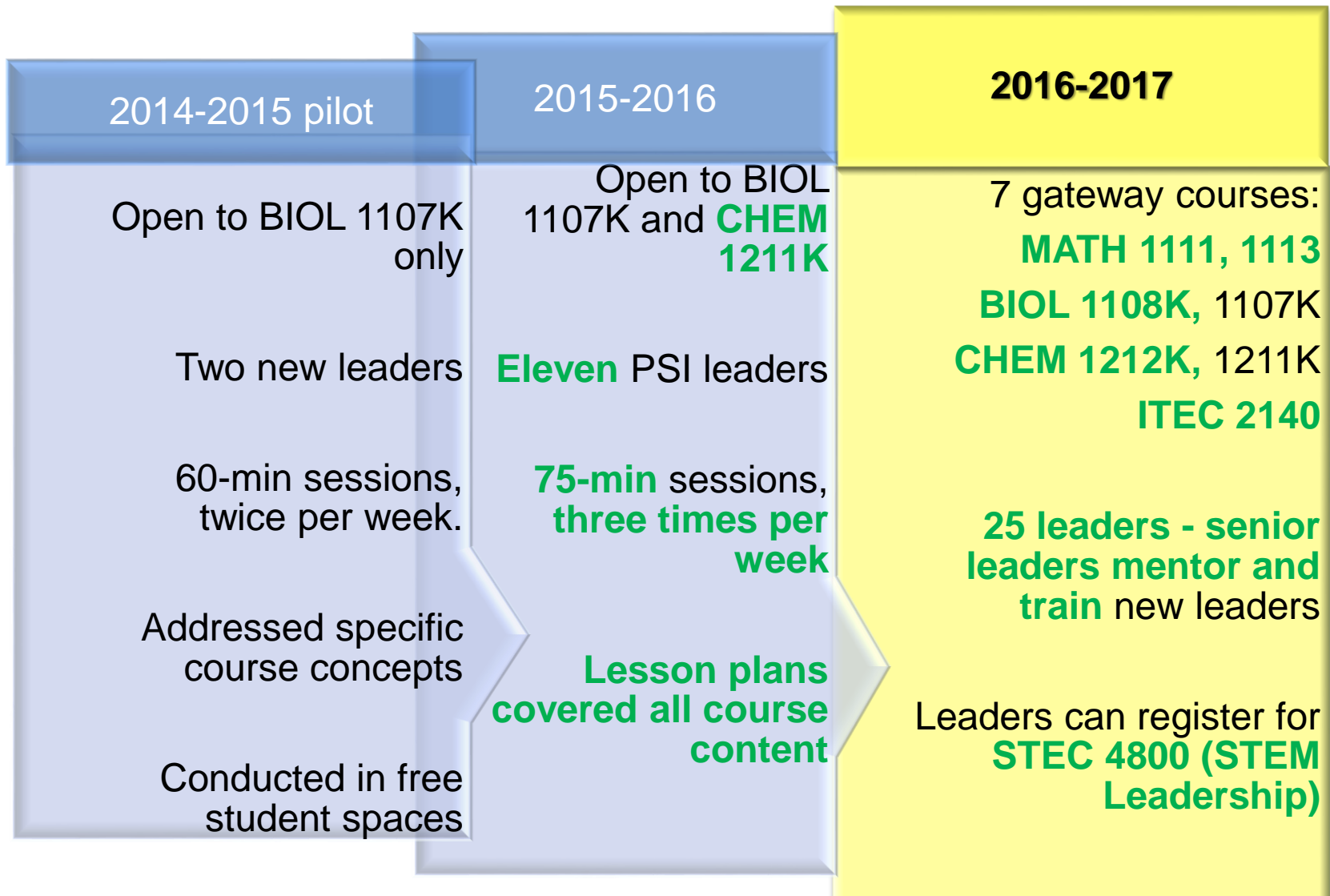
Grade distribution for fall 2015 (Mean  $\pm$  SEM).

- Historically difficult for students
- >25% D, F, or Withdrawal rate
- “Gateway” or prerequisite course for STEM majors

# PSI Intervention: 3 Key Objectives

1. To provide learning support for STEM students in traditionally challenging gateway courses → **reduce DFW rates.**
2. To equip students with **active learning strategies** tailored to STEM education.
3. To foster an academic culture of **collaborative learning** among STEM students.

# Evolution of PSI Program



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STEM Mini-grant (2014) → Complete College GA (2015) → **STEM EIP (2016-2018)**

# PSI Schedule: Spring 2017



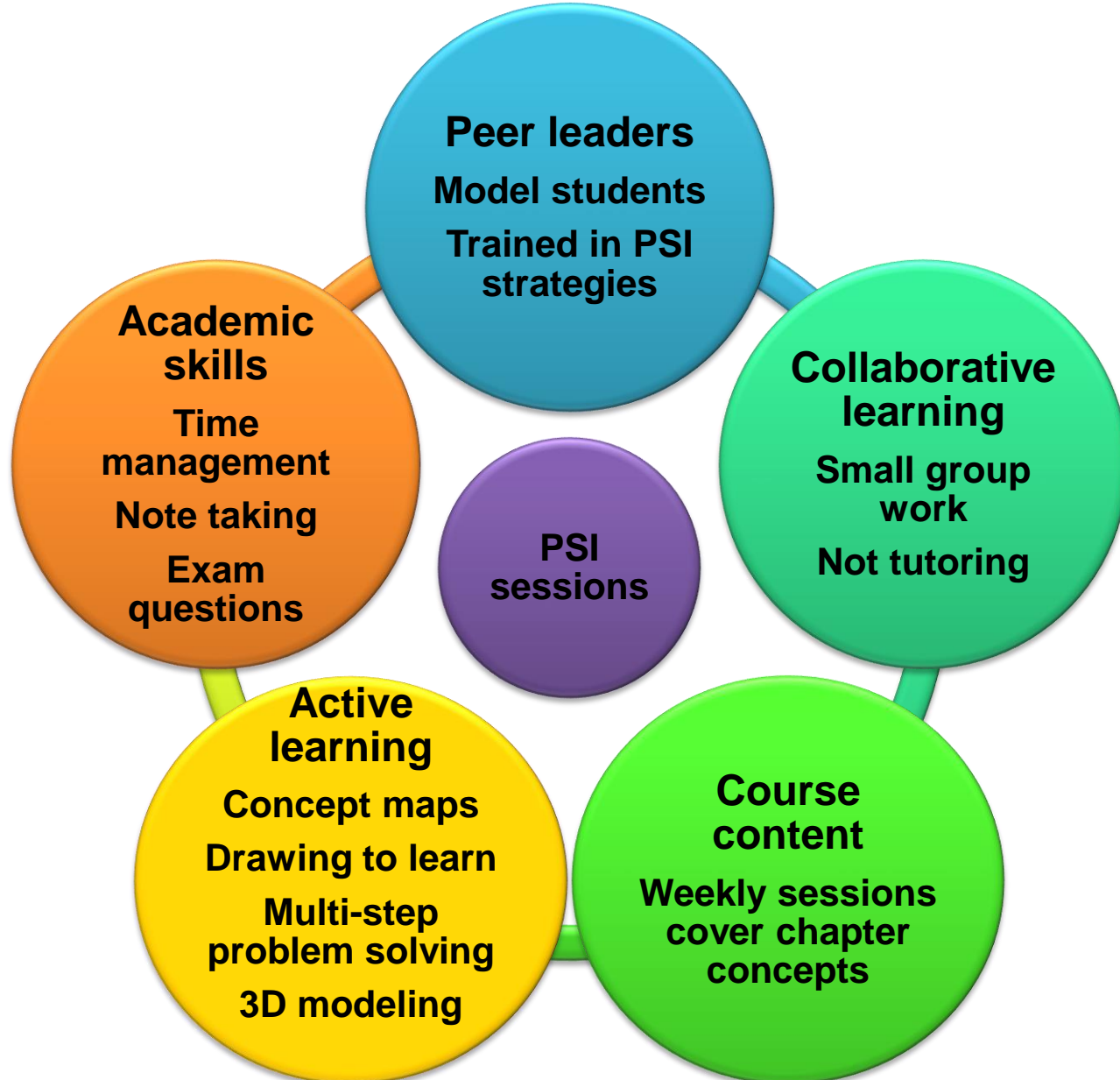
Peer Supplemental Instruction (PSI)  
**LEARN and GROW** with your neighborhood  
**STEM Grizzlies**

Come to our free PSI sessions!

BIOL 1107K	BIOL 1108K	CHEM 1211K	CHEM 1212K	MATH 1111	MATH 1113	ITEC 2140
M 1-2 H 2205	T 2-3:15 H 2205	T 2-3:15 A 1320	M 2-3 C 2220	M 12-1 A 1430	M 12:30-1:30 C 2100	M 2-3 C 2130
M 3-4 A 1280	W 1-2 H 2205	W 11-12 C 1110	T 1-2 H 1102	T 9:30-10:30 B 1800	T 2-3:15 A 1400	T 2-3:15 C 2125
T 2-3:15 H 1102	TH 2-3:15 H 2205	TH 2-3:15 A 1320	W 11-12 H 1102	TH 9:30-10:30 B 1800	W 9:30-10:30 B 1800	TH 2-3:15 C 2125
W 10-11 H 2208	F 1-2 H 2205		TH 2-3:15 A 1380	TH 2-3:15 A 1400	W 12:30-1:30 C 2100	
TH 2-3:15 H 1102						

*Questions? Ask your SST Professor about PSI.*

# Elements of our PSI program





# GGC SI Adaptations: STEM classes capped @24 students

## Traditional SI model

One SI Leader per course/instructor and 100-300 students/course

SI Session topics align 100% with course content

SI is organized through student learning support services

Leaders embedded in class only

# PSI Leaders

1. Strong STEM grades, works well with students, reliable; faculty recommendations

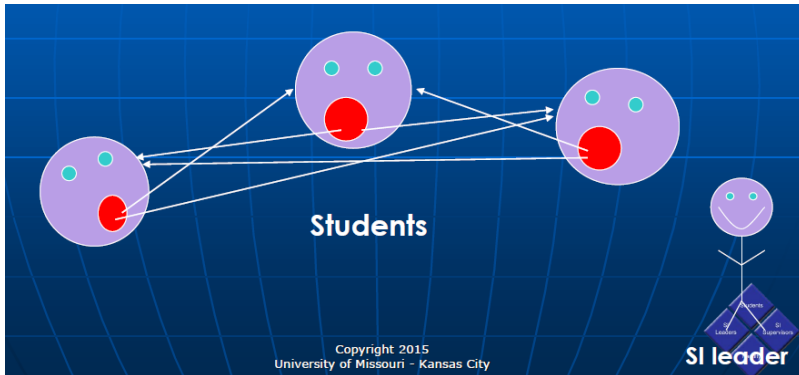
## 2. Training

- ✓ Pre-semester training day
- ✓ Lesson plans
- ✓ Faculty-Leader interactions
  - ❖ Weekly discipline meetings
  - ❖ Monthly interdisciplinary meetings; professional development
  - ❖ Faculty observations

# PSI Leader Training

## 1. Pre-semester training

- ✓ Facilitation techniques
- ✓ Active learning strategies



# PSI Session Planning

- Leaders prepare lesson plans
- Reviewed by faculty
- Three components:
  - Opening
  - Working
  - Closing

## PSI LESSON PLAN

Complete and submit at least 10 hours before the session. It's OK to write in the information and scan or use this electronic copy. Take this with you to the PSI session

PSI Leader:

Week/date:

Chapter:

Main lesson concept:

<b>7-10 minutes</b>	Session opening	Review of foundation concepts  Using this strategy:
<b>45-60 minutes</b>	Concept work	Sub-concept 1: Strategy:  Sub-concept 2: Strategy:
<b>10-15 minutes</b>	Session closing	Check for understanding:

Sessions are 75 minutes. Include worksheets, sketch of your plan e.g. matrix, questions on an informal quiz, vocabulary builder etc. and a key of what you expect students to do.

**Reflection on this session (Did it work? What would you do differently?):**

# BIOL 1107K PSI LESSON PLAN

PSI Leader: **Nailah Williamson**

Week/date: **Week 7 ( 2/27/2017)**

Chapter: **5**

Main lesson concept: **Passive and Active transport**

**7-10** Session **Background related to passive and active transport**

**minutes** opening

**Strategy: Snow ball**

1. Students write terms related to the cell membrane on a piece of paper, crumple the paper and throw to the center of the room.
2. Each student will pick a snow ball, read the term to the group and then describe as much as they can about the term. Brief discussion for clarification if needed.

This opening lays the foundation for understanding transport across the cell membrane.

Key terms students should cover: hydrophilic, hydrophobic, ions, fluid mosaic model, channels, concentration gradient, electrochemical gradient, active, passive, ATP.

**45-60** Concept **Sub-concept 1: (30 mins) Na<sup>+</sup>/K<sup>+</sup> pump**

**minutes** work

**Strategy: Group work/Board model**

1. Students will be grouped and instructed to draw the sodium potassium pump and annotate steps to explain the movements of molecules. Students use textbooks and online resources.
2. Groups will then take turns to explain the process of the movement of particles across the cell membrane to the other groups.

**Sub-concept 2: Active Transport (20 min)**

**Strategy: Matrix**

1. Students will first watch a video on active transport: <https://www.youtube.com/watch?v=1M7G6508IM>
2. Pairs of students will asked to complete the following matrix after watching the video.

	Direction of flow	Does or does not require ATP	With or against the Conc. gradient	Example:
Active transport				
Passive transport				

3. Students label a membrane diagram to indicate active or passive transport

**10-15** Session **Check for understanding**

**minutes** closing

**Strategy: Quick Quiz**

Students will submit anonymous answers to the questions below which will be reviewed by the leader.

1. Which ion is in a higher concentration outside of the cell (in the cytosol)?
2. What is the ratio of sodium's & potassium's that is transferred into and out of the cell?
3. What is needed for active transport to occur?

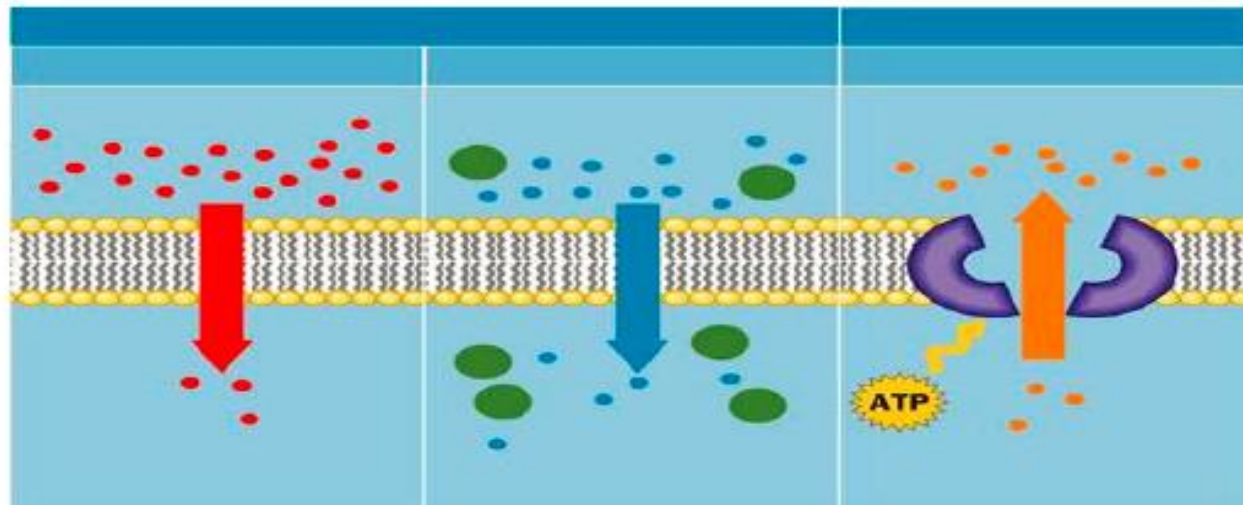
Sample  
lesson  
plan

**Solution/Key:**

**Sub-concept 2:**

	Direction of flow	Does or does not require ATP	With or against the Conc. gradient	Example:
Active transport	Low to high	Require ATP	Against	exocytosis, endocytosis
Passive transport	High to low	Does not require ATP	With	Simple diffusion, facilitated diffusion, osmosis

**Sub-Concept 3**



Passive

Passive if blue and active if green

Active

**Closing: Answers**

1. Sodium
2.  $3\text{Na}^+ : 2\text{K}^+$
3. ATP and a Channel protein
4. A. Passive does not require energy while active transport does.  
B. The types of transport vary.
  - For active transport; Endocytosis, Exocytosis and cell membrane/sodium-potassium pump
  - For Passive transport; Diffusion, facilitated diffusion and osmosis



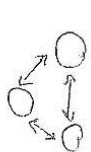
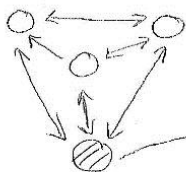
# Session Observations by faculty

PSI Session Information			
Date	11/3/2015	Room No.	H2205
Time	2pm-3pm	Course(s)	BIOL1107
Leader(s)	Jimmy and Janyne		
Auditor(s)	Jennifer Hirst-Kennedy		
Topic(s)	various Calvin cycle, glycolysis, mitosis		

PSI Session Observations					
SI Leader(s) are Prepared					
#	Item	Yes	No	N/A	Notes
1	Leader(s) knowledgeable of course content	X			
2	Participation log available/filled in	X			
3	Leader addresses students' needs/questions	X			
4	Lesson plan available during session	X	⊗	⊗	<del>scribbles</del>
Atmosphere of Session					
#	Item	Yes	No	N/A	Notes
5	Session beginning on time			X	auditor arrived late
6	Agenda set at beginning of session	X			- pick difficult topic - make test questions or figure/chart - present to others & discuss
7	Room arranged for group work/students working in groups	X			students worked at boards
8	Students doing most of the talking (solving together)	X			
9	Students explaining material back to leader	X			
10	Students referring to textbooks and notes for info, rather than leader	X			students also encouraged to use Google, YouTube
11	All students participating in session	X			
12	Leaders managing time; using a timer for activities	X			reminded students of time frequently to keep on track
Effective Use of Facilitation & Learning Strategies					
#	Item	Yes	No	N/A	Notes
13	Facilitation by redirection, wait-time and/or check for understanding	X			
14	Learning strategies employed for opening, working through and closing session	X			
15	Leaders explain purpose and benefit of employed learning strategy(ies)	X			said that these learning activities are good study techniques

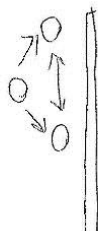
○ = students  
⊗ = PSI leaders

board



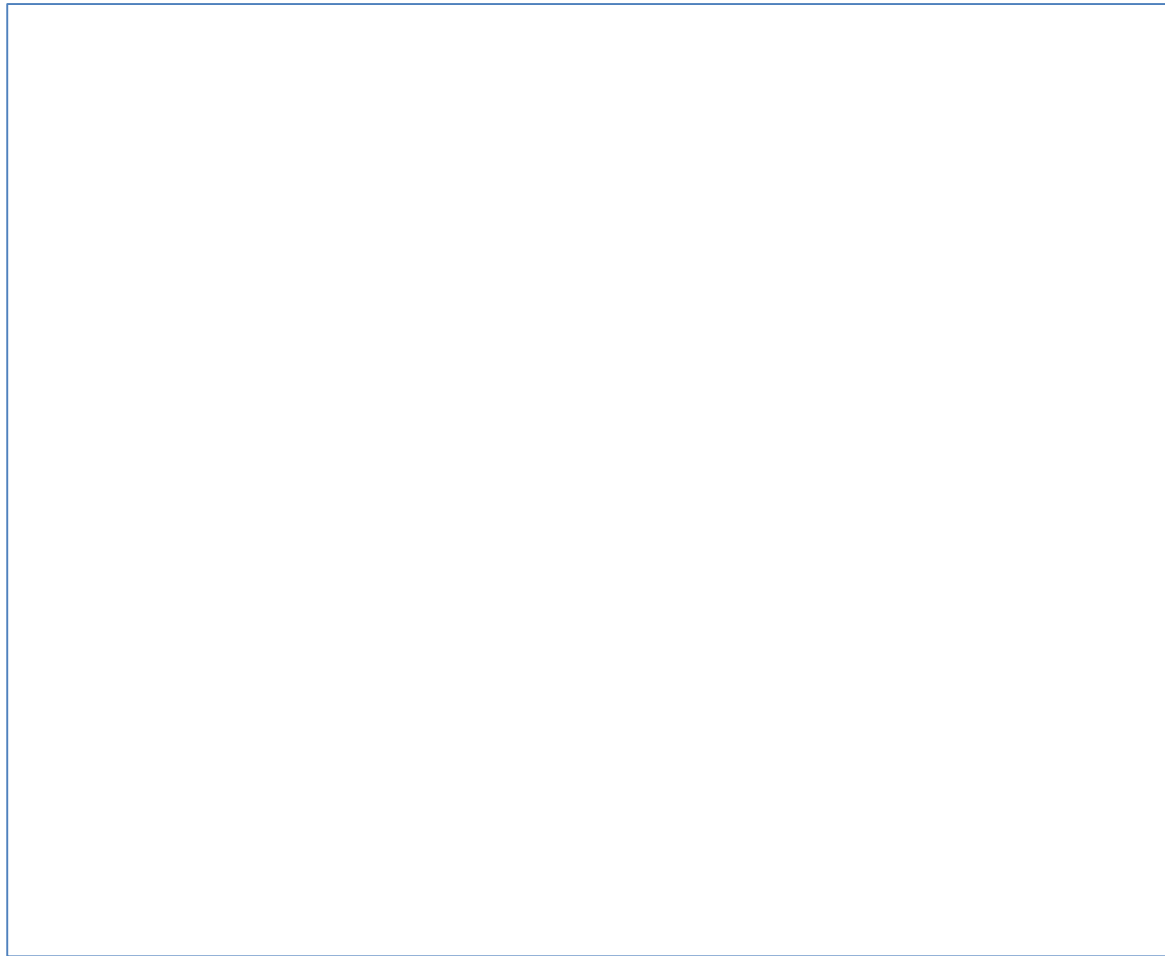
- PSI leaders rotated around the room and checked in with each group  
- PSI leaders had students explain charts/figures & questions

\* students spent more time talking to each than with PSI Leaders



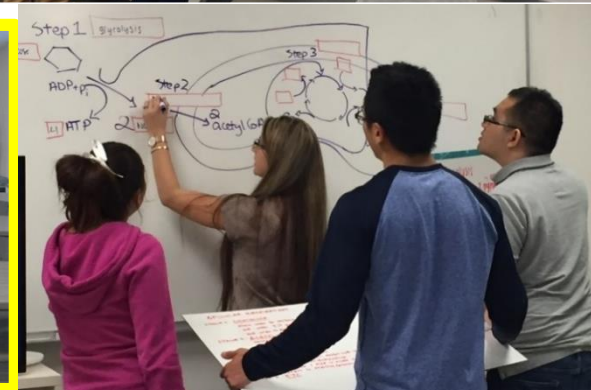
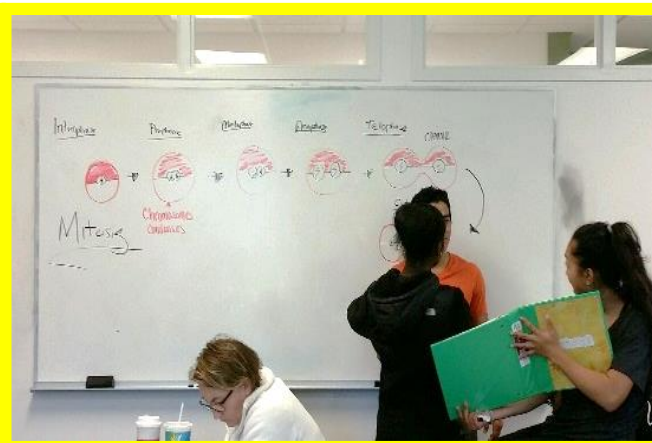
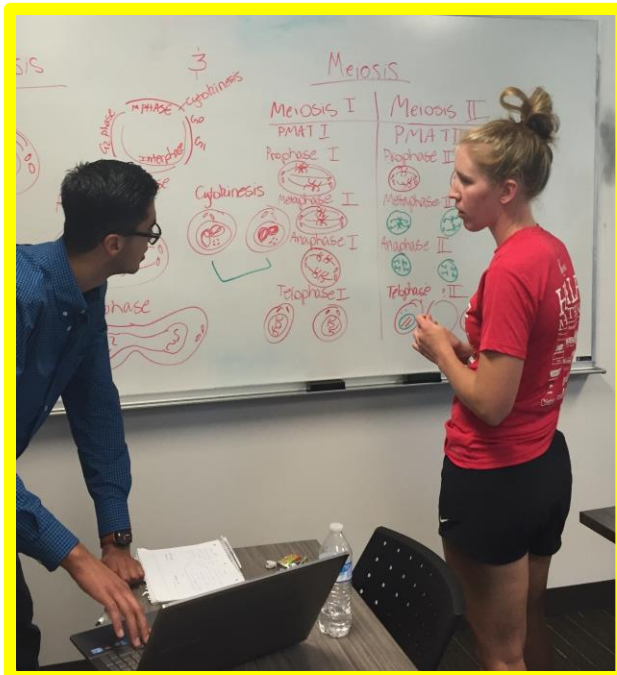
16. Learning Strategies Employed During Session: drawing on the board, writing own exam questions  
17. At the back of this sheet, diagram the communication/interaction between leaders and students making own figures

# PSI video by Super leader Brittany X

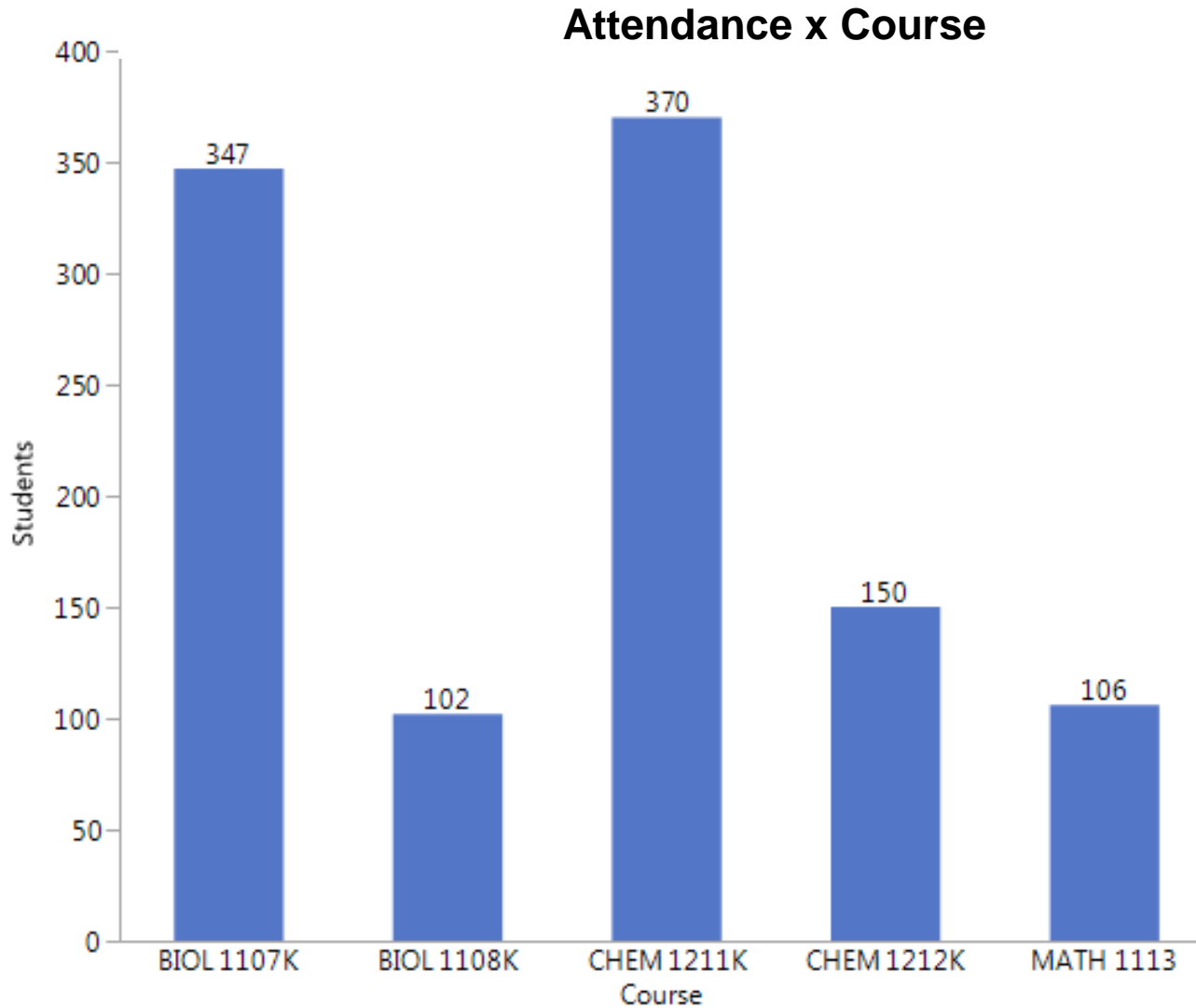




# PSI in action!

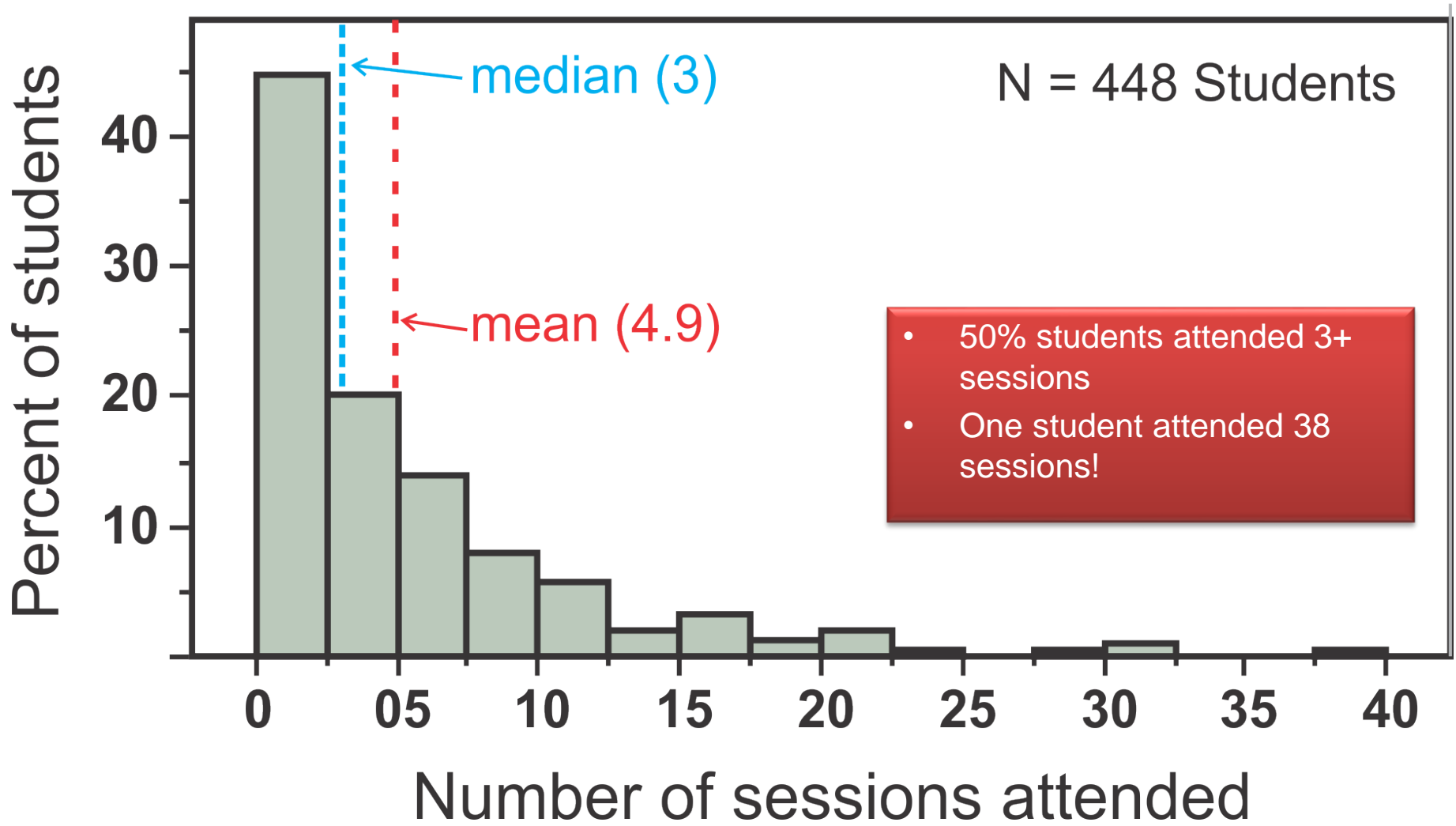


# PSI Attendance



# PSI Attendance: Biology

Frequency of attendance



# PSI Incentive study

- How can we improve attendance at PSI sessions?
- Can students be incentivized to attend more sessions?

Instructors offer PSI under varying conditions:

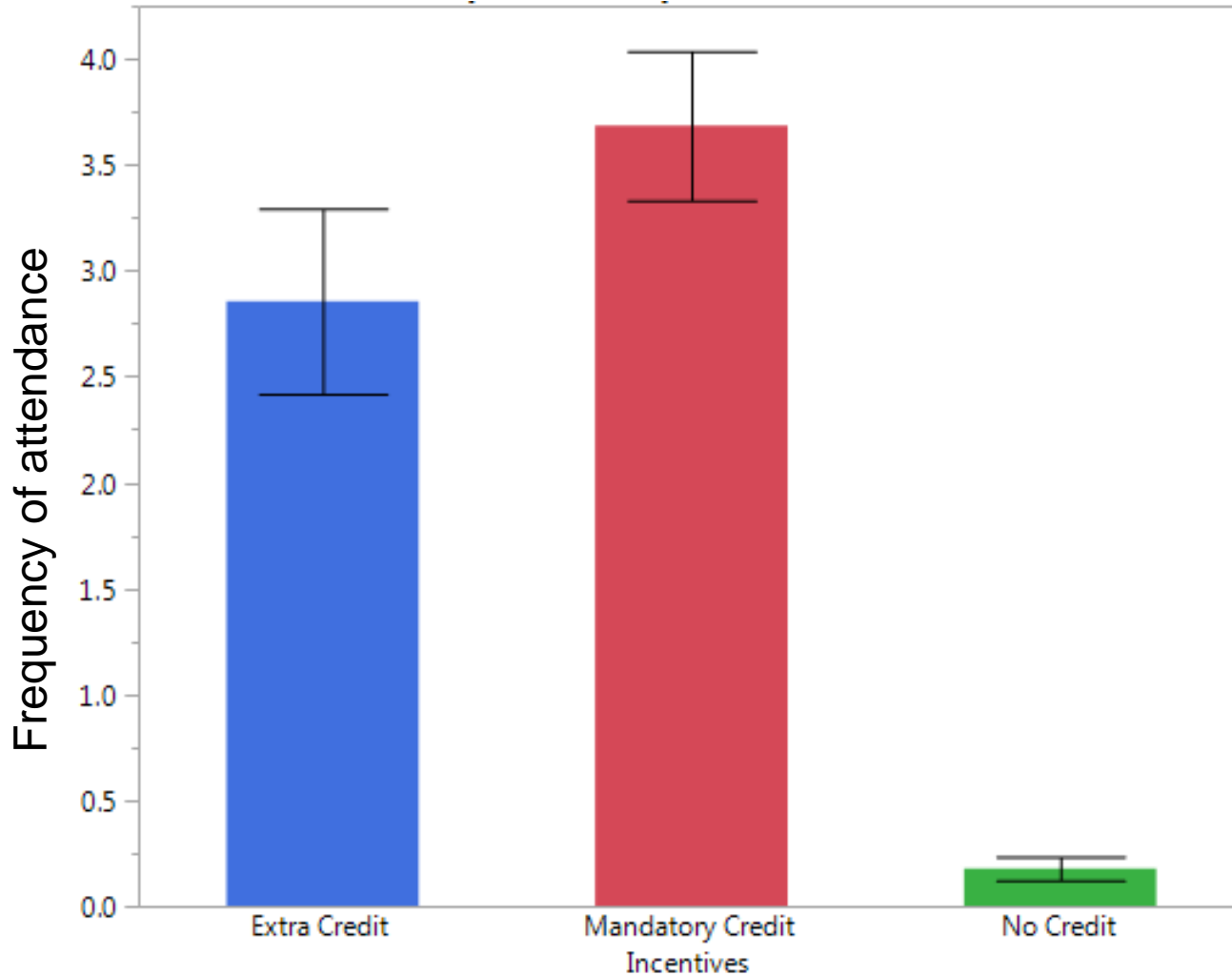
A. Voluntary

B. Participation credit (5 PSI/tutoring sessions by mid-term)

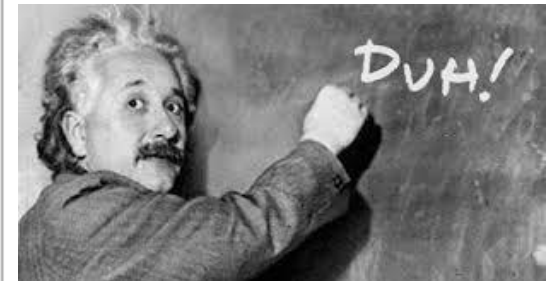
C. Extra credit (5 PSI/tutoring sessions by mid-term)

# PSI Attendance

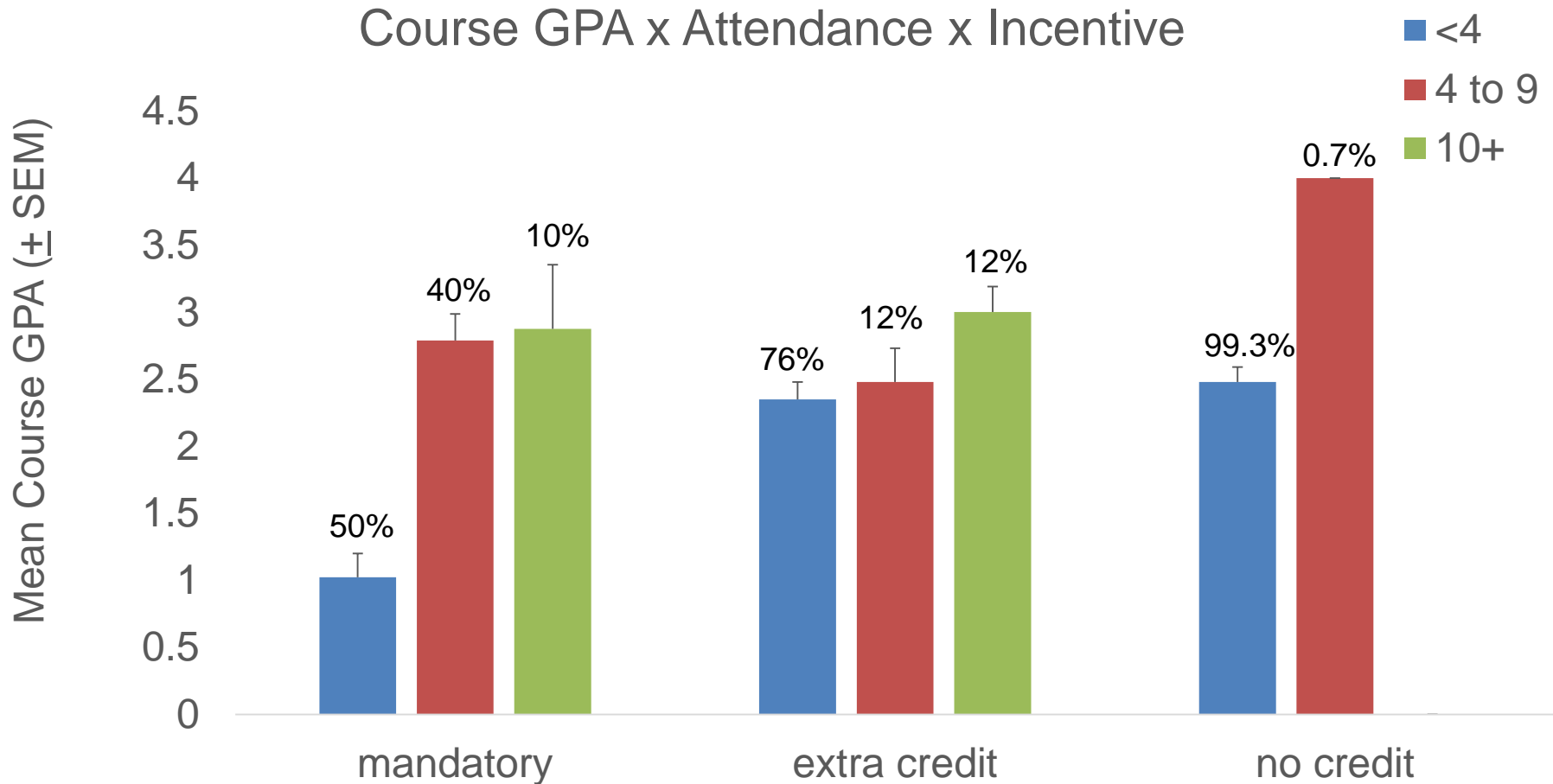
Attendance x Incentive



Students go to more sessions on average with incentives



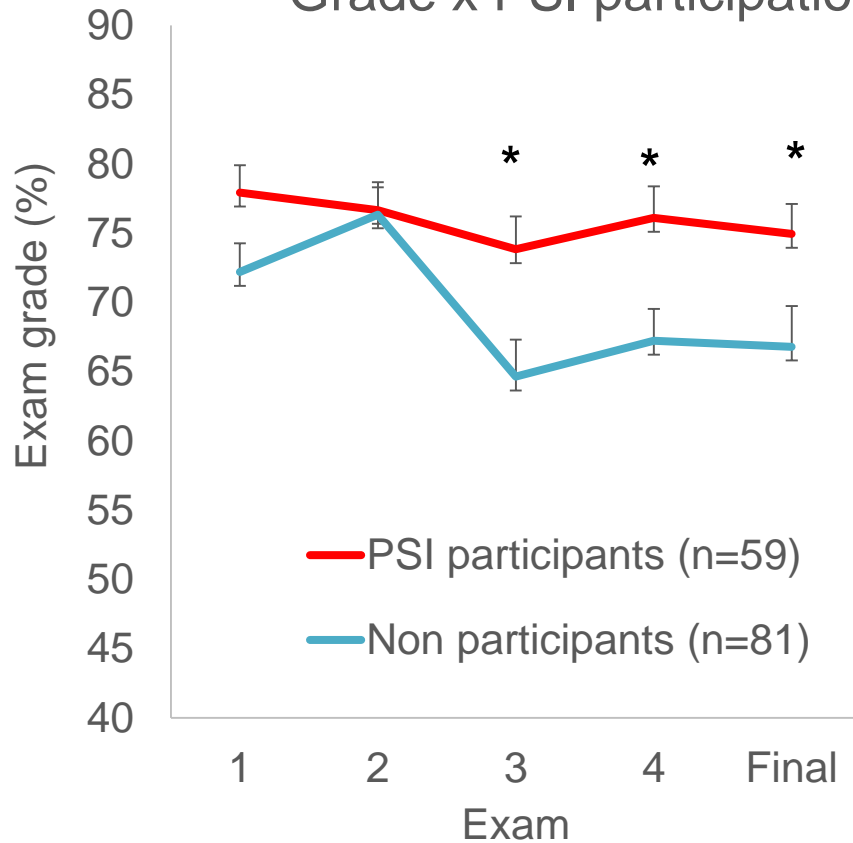
# Spring 2017: Course Performance in Biology



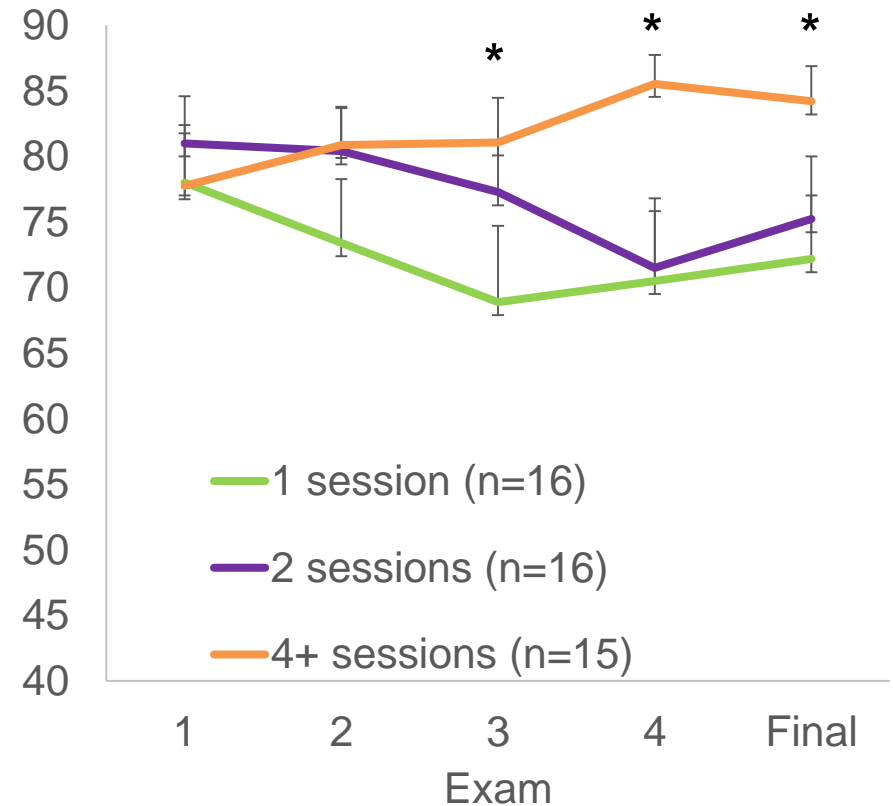
- Mandatory - Only 50% of students met requirement
- Correlation of increased attendance and course grade

# Fall 2015: Exam Performance in BIOL 1107K

## Grade x PSI participation



## Grade x Frequency of attendance

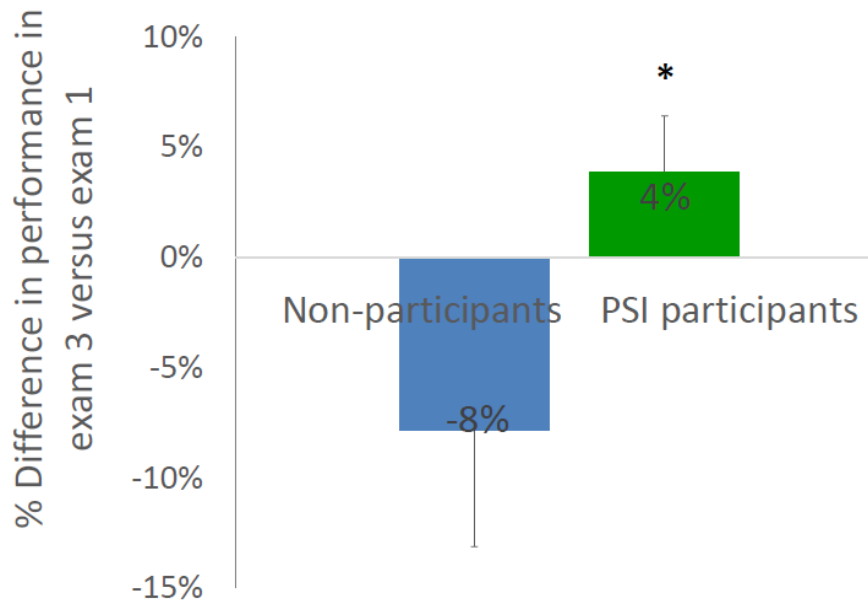


\*  $p < 0.05$ , Student's t-test

- Significant effect of participation
- Higher grades 4+ sessions

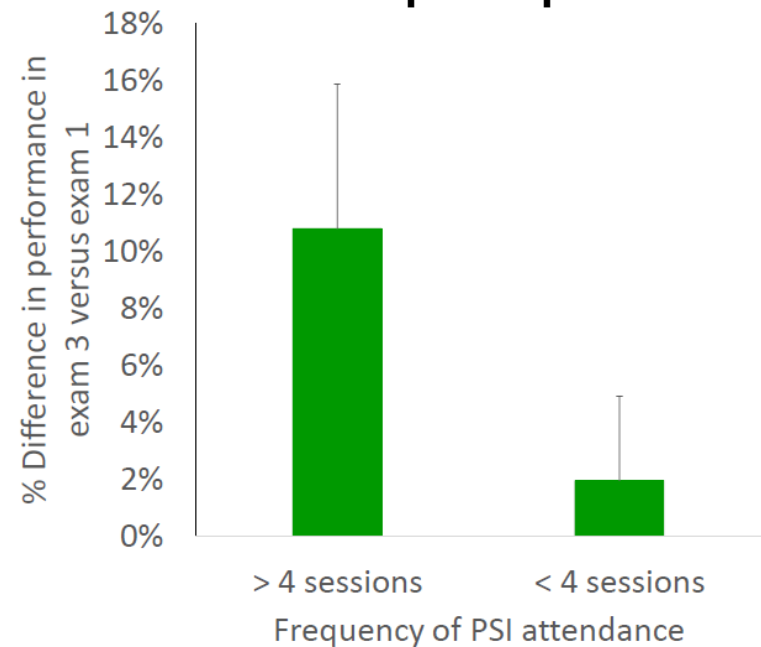
# Spring 2016: Exam Performance in BIOL 1107K

## PSI participation



PSI participants show higher exam scores than non-participants.  
t-test  $p < 0.05$

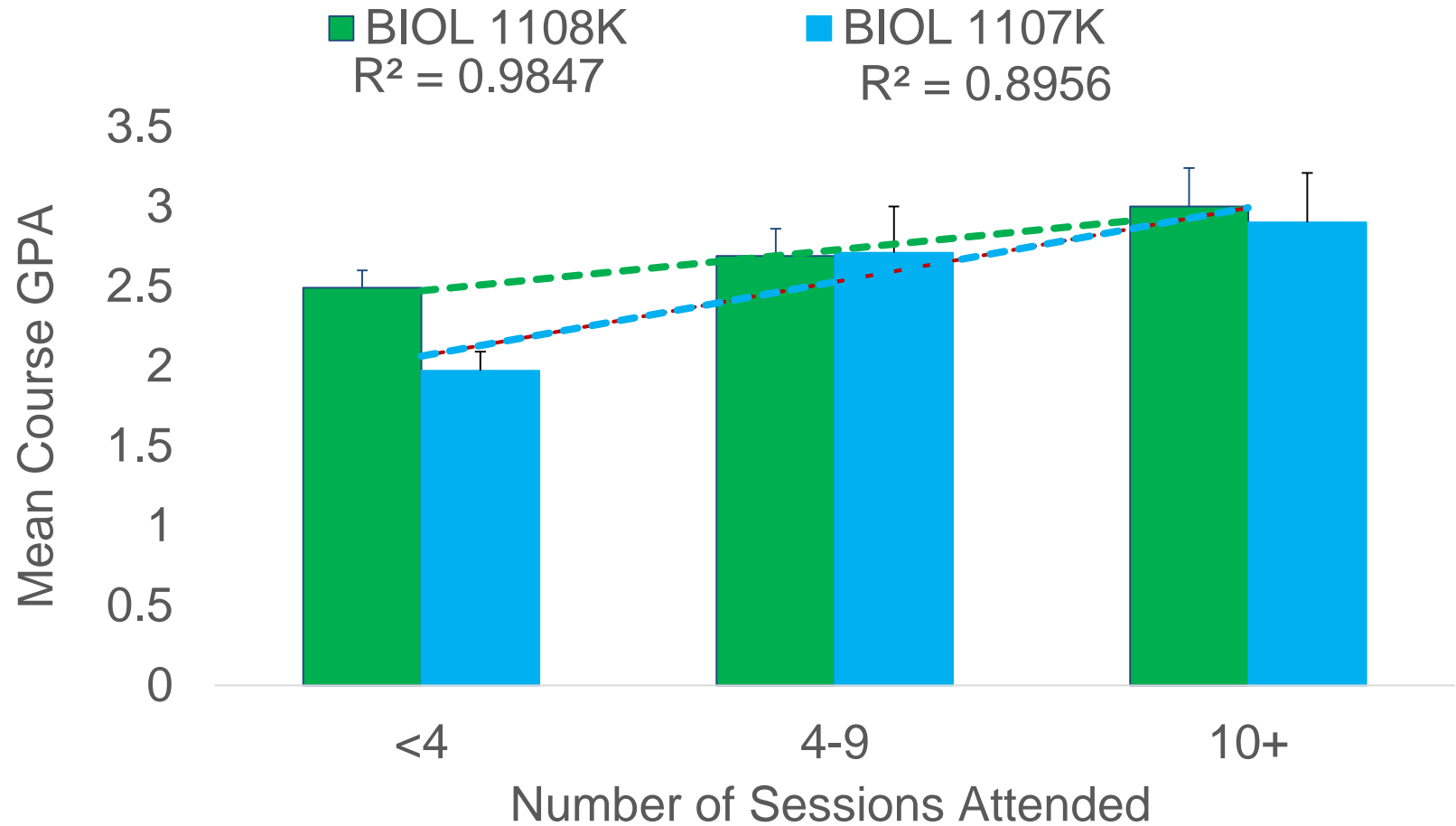
## Frequency of PSI participation



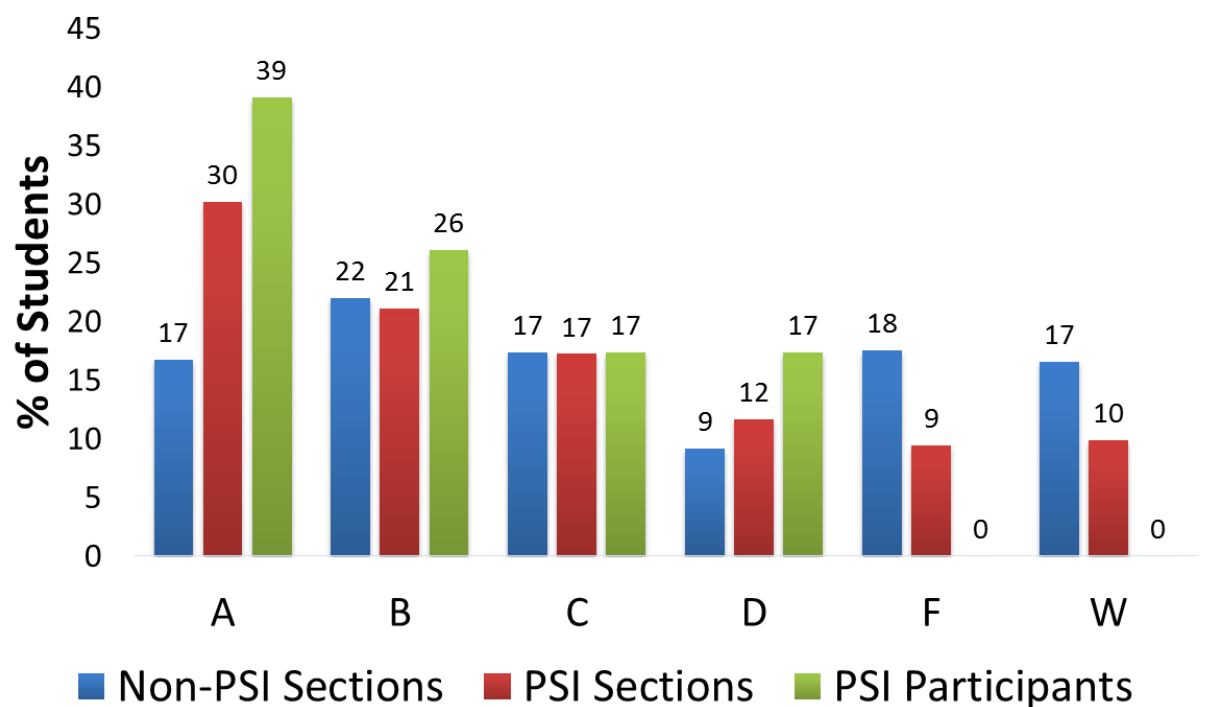
PSI participants who attend 4+ sessions score approximately a letter grade higher



# Spring 2017: Course Performance in Biology



# PSI participants in CHEM 1211K have fewer DFWs



Aggregate grade distribution. Comparison of course grades for students in the non-participating sections (n = 583, blue), participating sections (n = 231, red), and students who attended PSI sessions (n = 23, green).

# Benefits to PSI Leaders

- Professional development opportunities



Victoria and Janyne presented on PSI activities at the **American Society for Cell Biology conference**, Dec 2015

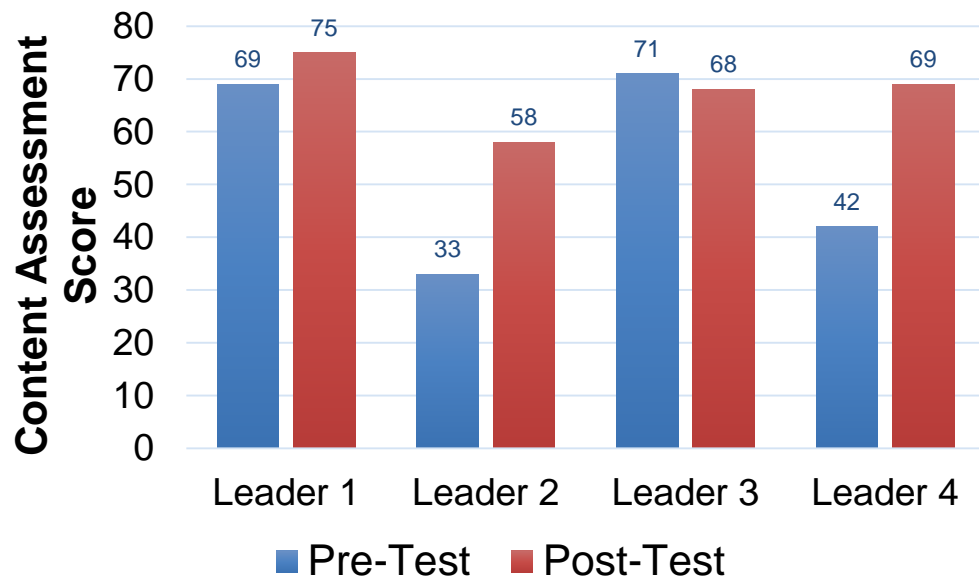


Paul and Jonathon presented on PSI learning strategies at GGC's annual STEM symposium, May 2017

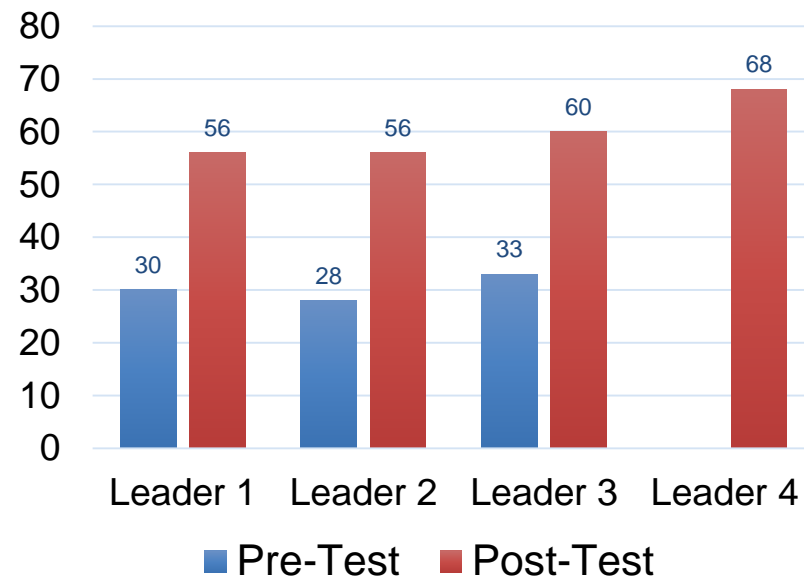
# Benefits to PSI Leaders

- Pre- and Post-semester concept tests

CHEM 1211K



CHEM 1212K



# Benefits to PSI Leaders

- End-of-semester Reflections Survey

Skills learnt :

- Scientific communication
- Time management
- Leadership
- Public speaking
- Learning strategies
- Teamwork
- Patience

Other benefits:

- Increased confidence in STEM
- Relearning biology is helpful for the MCAT and PCAT
- Experience to acquire a TA position in graduate schools
- Gratification in seeing students improve in grades and confidence
- STEC 4800 course credit opportunity

# Overall Assessment

## Student impact

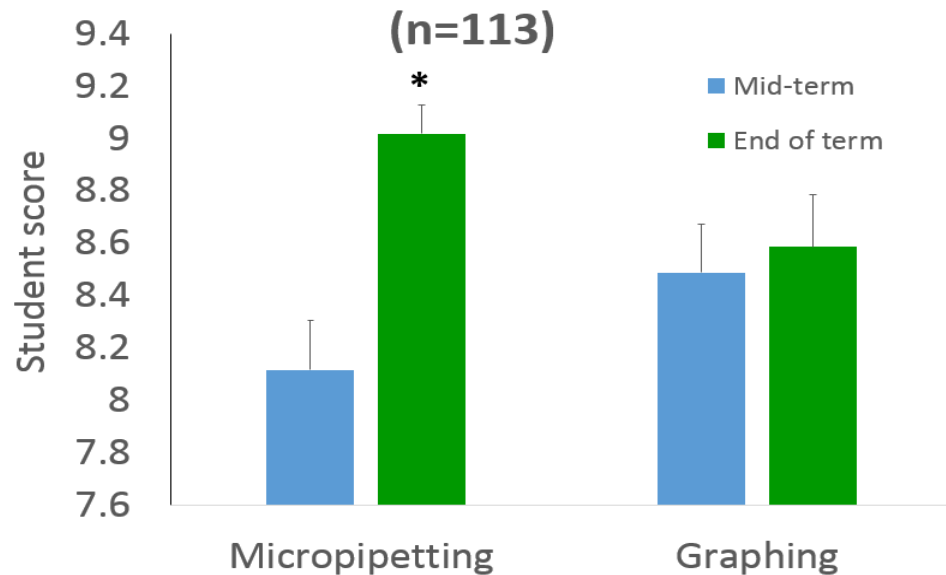
- Students participating in PSI sessions
  - Participate more when incentivized but no incentive increased FREQUENCY of attendance
  - Correlation between exam/course performance and frequency
  - requested PSI support in other courses; for longer periods and more sessions; began their own PSI sessions → **culture of collaborative learning!!**
- PSI Leaders
  - showed significantly improved mastery of basic course principles
  - reported increased confidence in current STEM courses
  - developed new skills and clearer about career aspirations

## Challenges

- Student participation (max of 25%)
- Meeting the needs of multiple course sections in one session

# Future directions: PSI Lab Skills

Goal: To improve competency in **STEM skills** (Vision and Change, Biology)

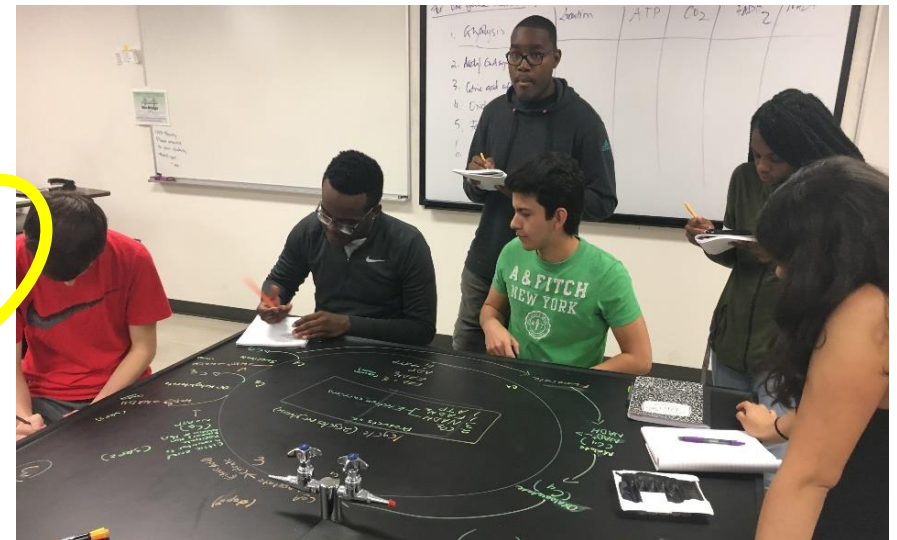
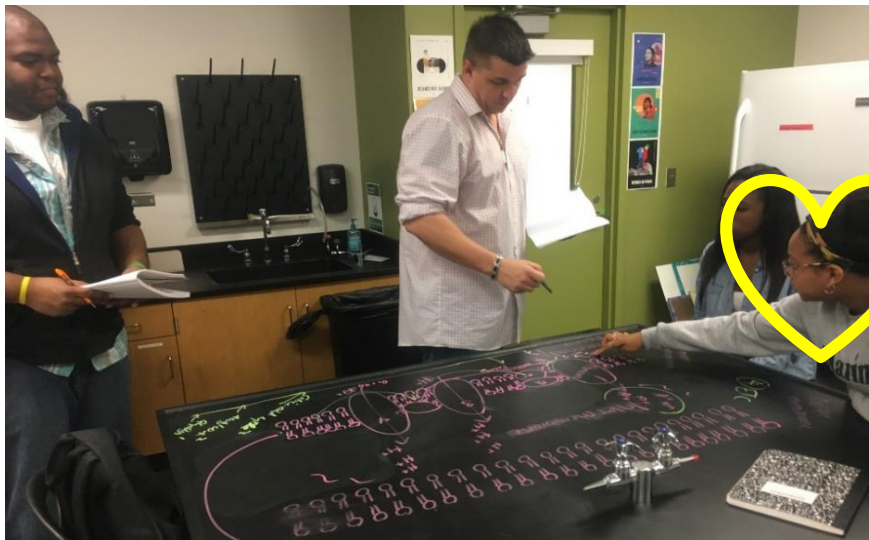


Fall 2015: leaders embedded in biology labs to assist and assess graphing and micropipetting skills. Student's t-test, \* $p < 0.01$ ,  $n = 113$ .



# Future directions: Blended LA+PSI model

Goal: To enhance learning in the classroom and establish rapport between leaders and students.





# Acknowledgements

## *Biology*

- Christopher Brown
- Jennifer Hurst-Kennedy
- Judy Awong-Taylor
- Cindy Achat-Mendes

## *Chemistry*

- Benjamin Shepler
- Chantelle Anfuso
- Rashad Simmons

## *Mathematics*

- Katherine Pinzon
- Jamye Curry

## *Information Technology*

- Cynthia Johnson
- Sonal Dekhane

The PSI program is a component of Georgia Gwinnet College's grant "***Improving P-16 STEM Performance with High Student Engagement Strategies***" which is supported by the University System of Georgia's Board of Regents **STEM Initiative Education Improvement Plan**

# Questions?



Fall  
2014



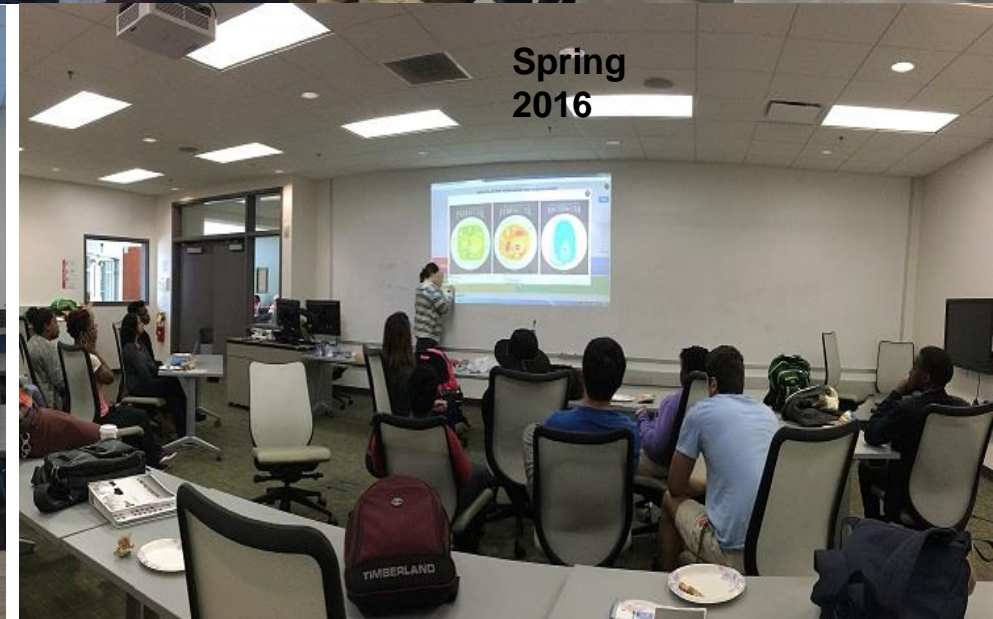
Spring  
2015



Spring  
2015



Fall  
2015



Spring  
2016