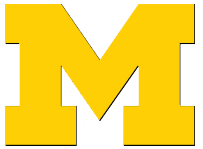
# Lessons Learned from Measuring Student Behavior During Class

PERRY SAMSON

UNIVERSITY OF MICHIGAN-ANN ARBOR



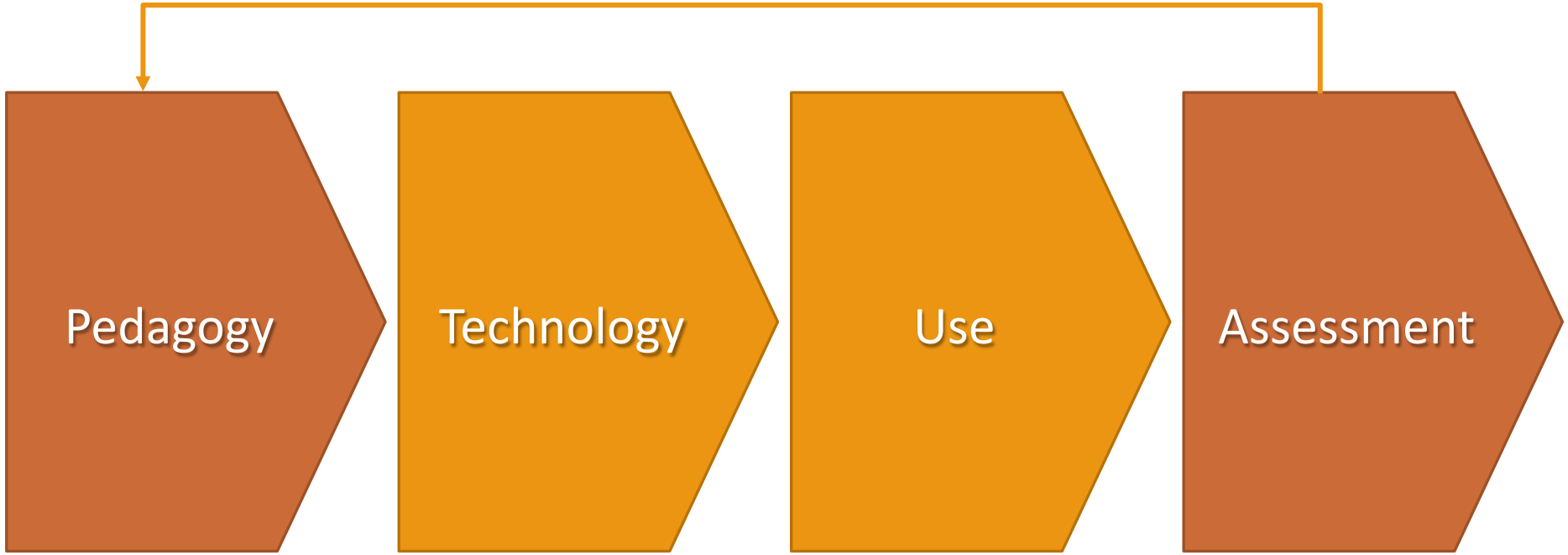

Class Presentation
TECHNOLOGY
Face-to-Face
Synchronous Remote
Asynchronous Remote

# What Do We Need in the Classroom?

- Students should be challenged with a wide range of question types
- Students should be able to access my slides
- Students should be able to take notes
- Students should be encouraged to ask questions
- Students should be able to answer each other's questions
- Students should be able to indicate when they're confused
- Student notes should be linked to lecture capture

# Creating an Ecosystem

# How to Build Educational Technology



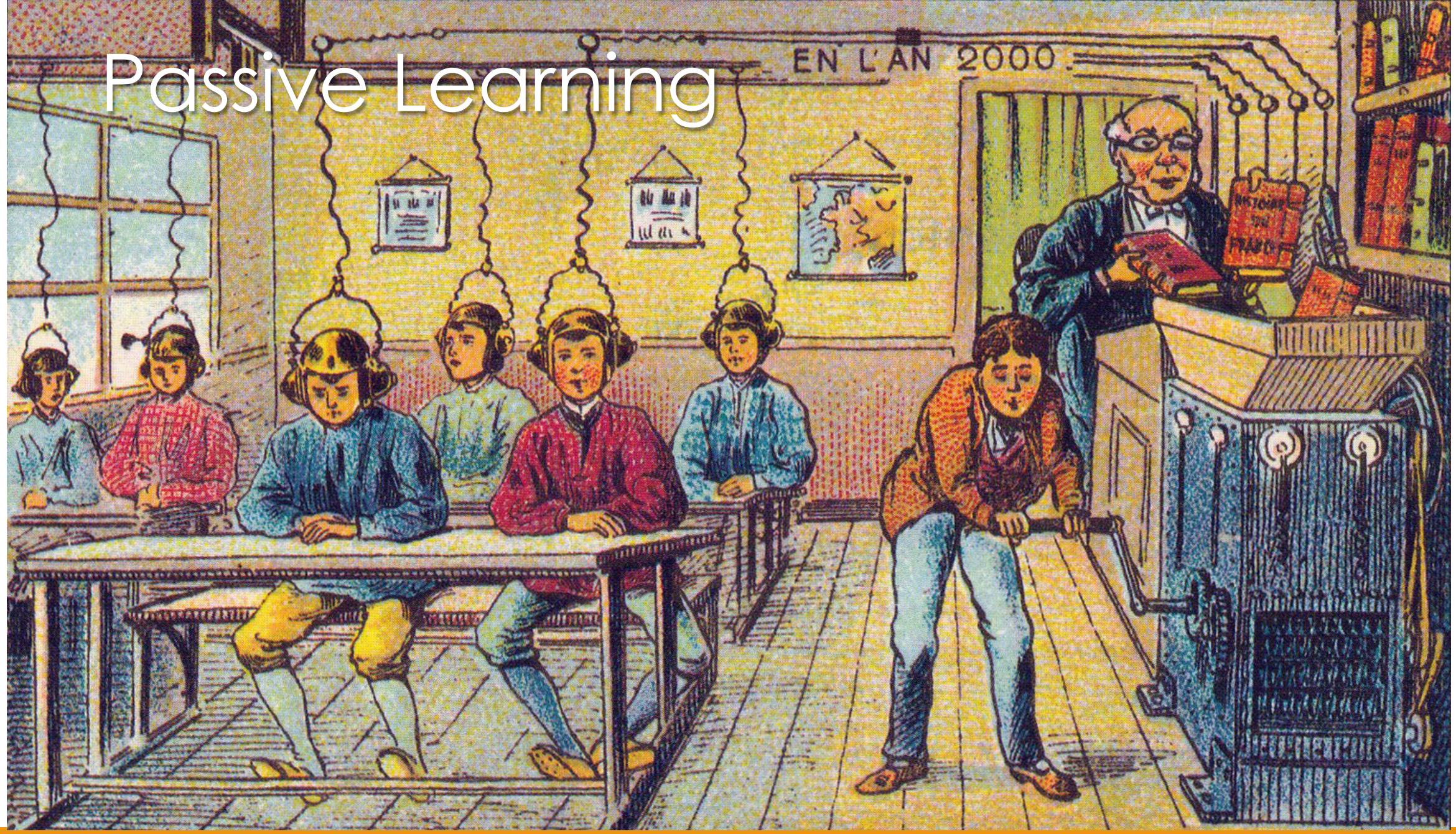
# Active Learning Definition

**Active learning** is a process whereby students engage in activities, such as reading, writing, discussion, or problem solving that promote analysis, synthesis, and evaluation of class content.

www.crlt.umich.edu/tstrategies/tsal

# Active Learning

# Passive Learning



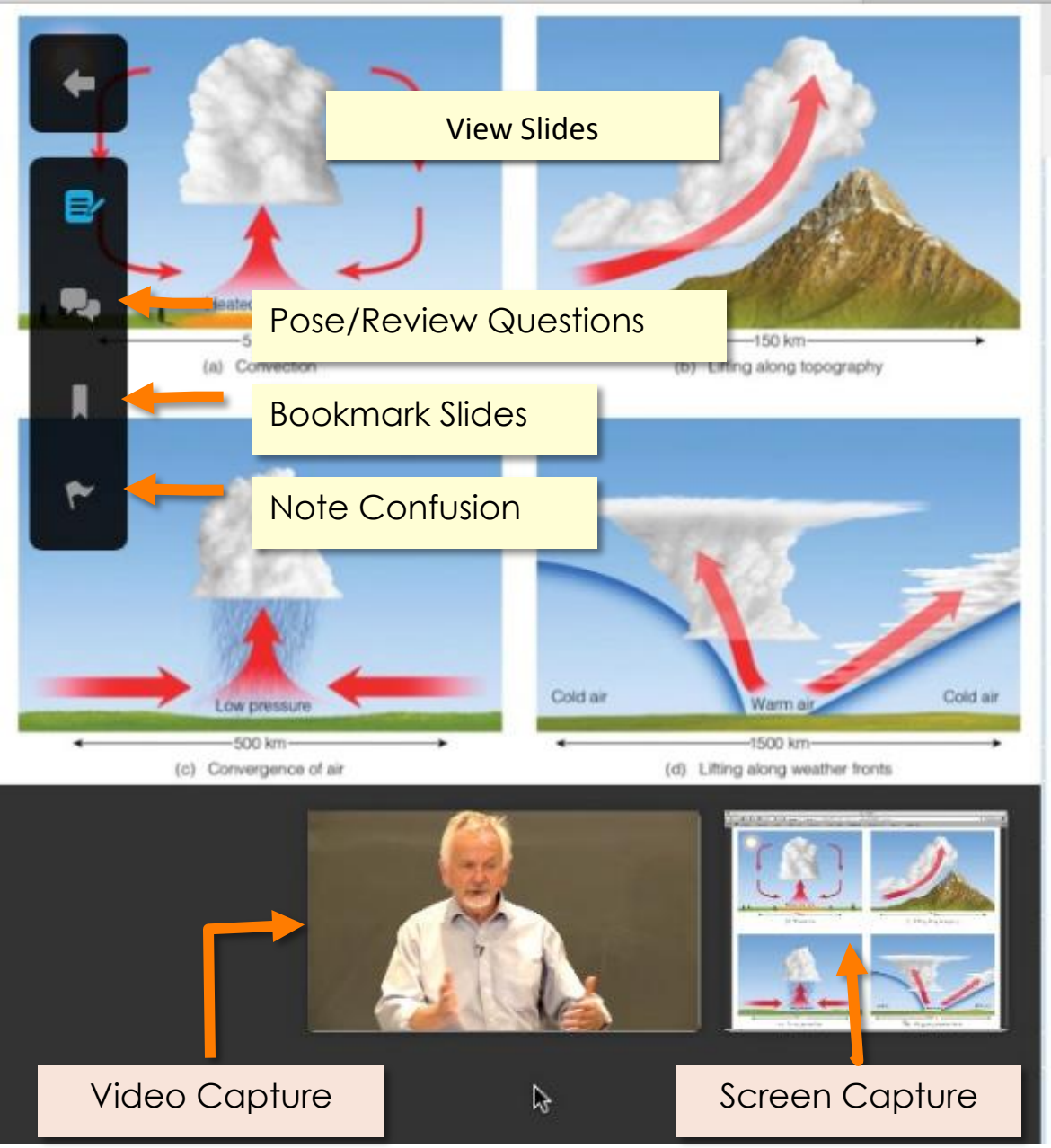

Villemard, 1900 Prediction for the *French School in Year 2000*

# Active Learning

"The studies analyzed here document that active learning leads to increases in examination performance that would raise average grades by a half a letter, and that failure rates under traditional lecturing increase by 55% over the rates observed under active learning."

Freeman et al. (2014)
**Active learning increases student performance in science, engineering, and mathematics**
PNAS 2014 111 (23) 8410-8415

Classroom | LectureTools, Inc. - Calendar







Notes

| | | |
|---|---|---|
| + | 11 | Things that make the lapse rate |
| + | 5 | Dry air 10 degrees per K, saturated=6 degrees per k. Moist adiabatic lapse rate. |
| + | 11 | If the temperature is dropping rapidly with altitude, the air is unstable. |
| + | 2 | Without the addition of heat. |
| + | 7 | 2 degrees per k ometer here. |
| + | 11 | Bookmark |
| + | 10 | Environm theoretica |
| + | 3 | When you rise a kilometer temp drops 10 degrees, but only if the air is dry. |
| + | 2 | Bookmark |
| + | 13 | Air does not like to move vertically |
| + | 3 | That is why the top of mountains are colder. Called the dry adiabatic lapse rate. |
| + | 15 | Going over the mountain air warms at dry adiabatic lapse rate |
| + | 14 | In cloud from 1500 m to top of mountain. |
| + | + | Bookmark |
| 4:39 | 5 | N |
| + | 13 | Bookmark |

Take Notes

# Student View

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## Active Learning Platform

# 001-AOSS 102 - 001 Extreme Weather



NEW QUESTION | Sep 10 - Sun-Earth Relationship 9 New | Search | Sort Newest

Sep 10 - Sun-Earth Relationship Sep 10, 2014 9:48 AM

**Why are more energetic wavelengths more dangerous?**

0 2

Sep 10 - Sun-Earth Relationship Sep 10, 2014 9:43 AM

I'm looking at http://astrosun2.astro.cornell.edu/academics/courses/astro201/wiens_law.htm and it says b is 0.29. Is there any reason why?

0 2

Sep 10 - Sun-Earth Relationship Sep 10, 2014 9:40 AM

What does the B stand for again?

0 1

2 0

Sep 10 - Sun-Earth Relationship Sep 10, 2014 9:48 AM by Anonymous

## Why are more energetic wavelengths more dangerous?

0 2

Sep 10, 2014 9:49 AM by Nathan Hamet

They have the potential to literally rip apart your cells because of the high energy.

0

Sep 10, 2014 9:50 AM by Anonymous

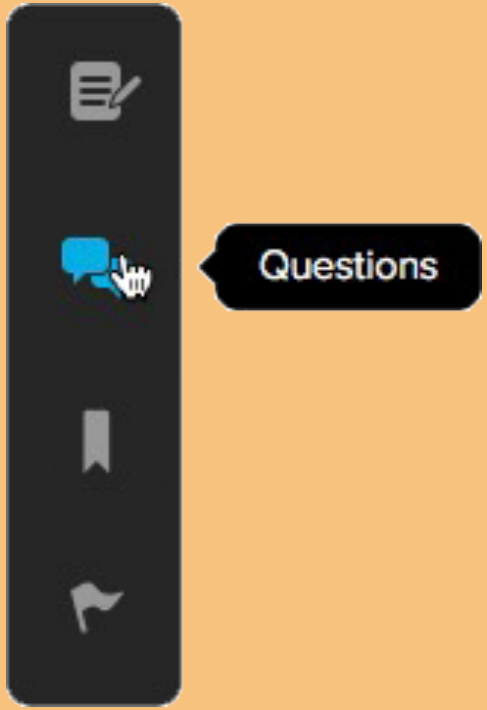
In the case of nuclear radiation, high energy wavelengths can destroy chromosomal ability to replicate.

0

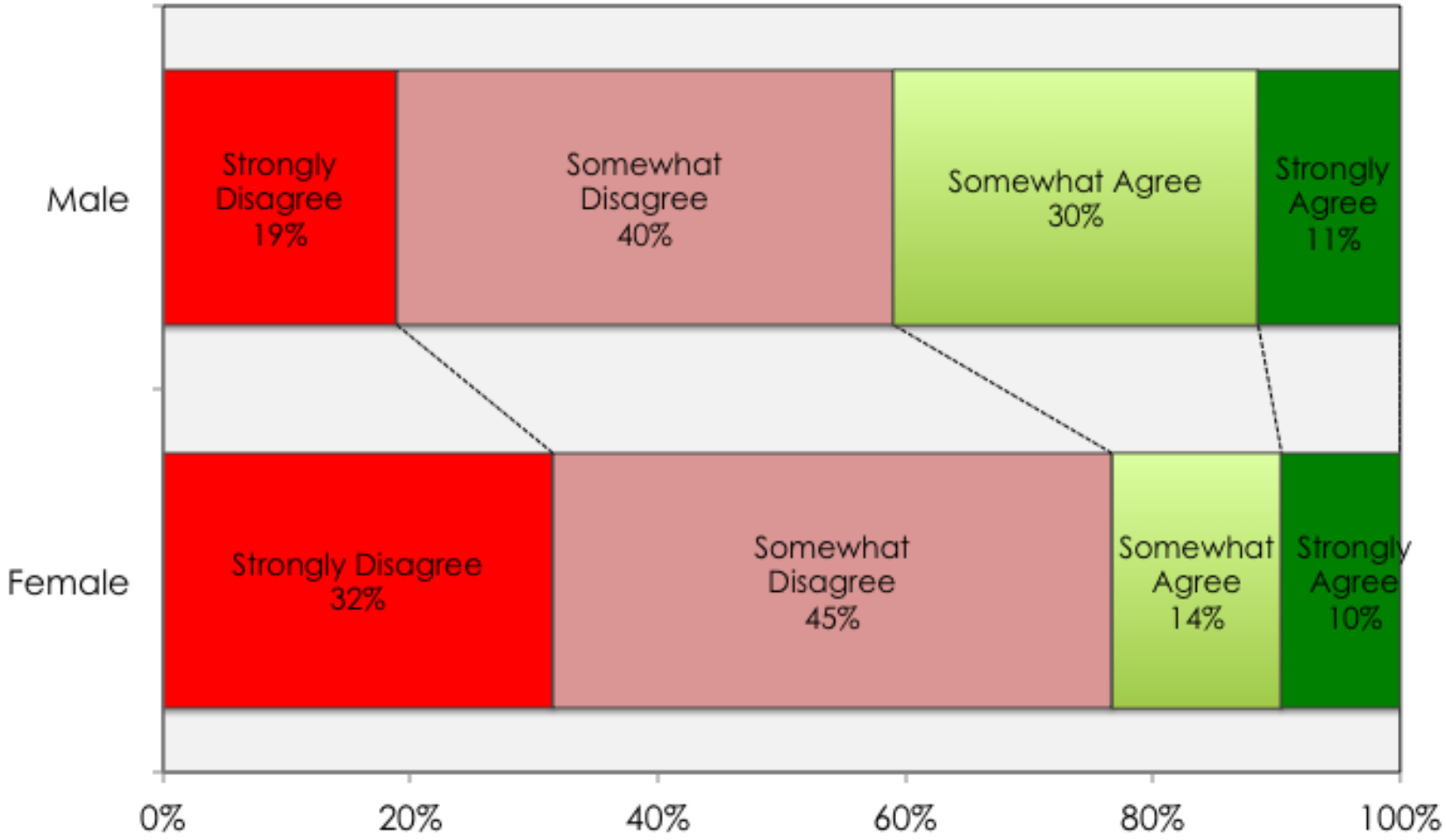
RESPOND TO THIS QUESTION

Display a menu

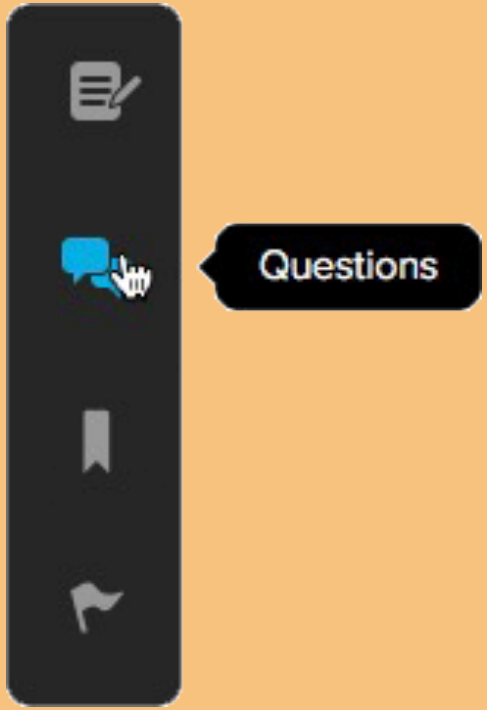
# The Value of Anonymity in Inquiry




**Q.** When I have questions in class, I am comfortable asking them verbally.



# The Value of Anonymity in Inquiry

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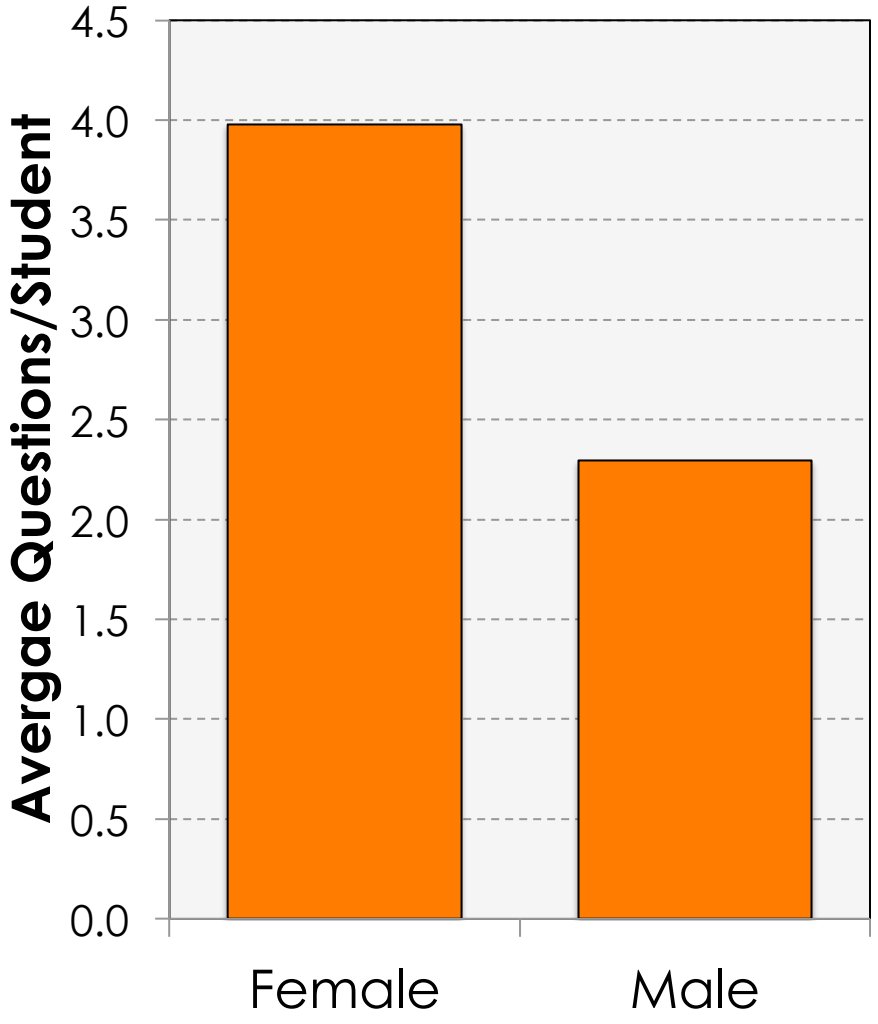
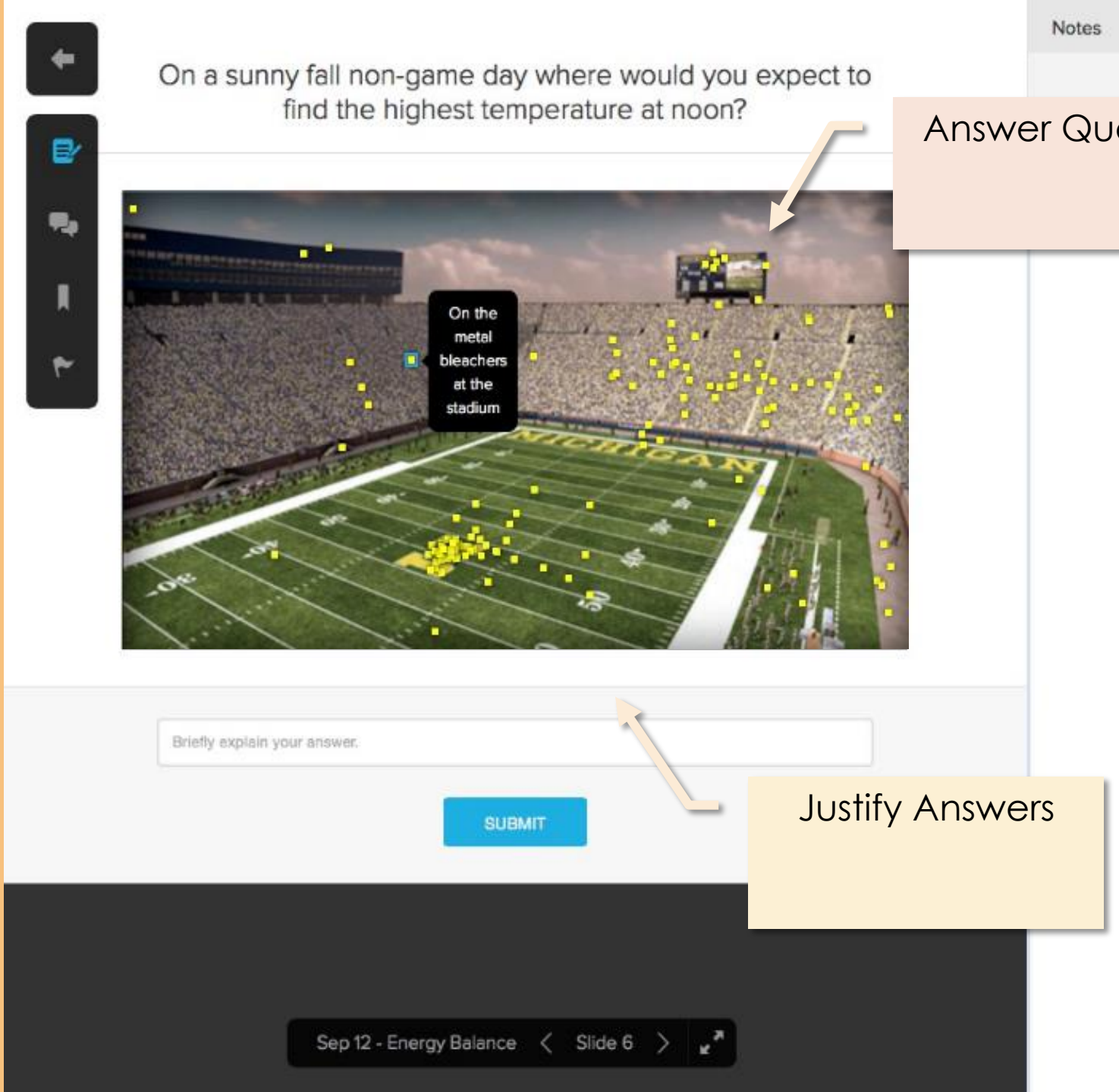



| | |
|---|---|
| **Number of students** | **158** |
| Number of questions asked | 413 |
| Average number of questions per student | 2.7 |

# Image-Base Questions

*Optional:*

*Require students to justify their selection.*



# Multiple Choice

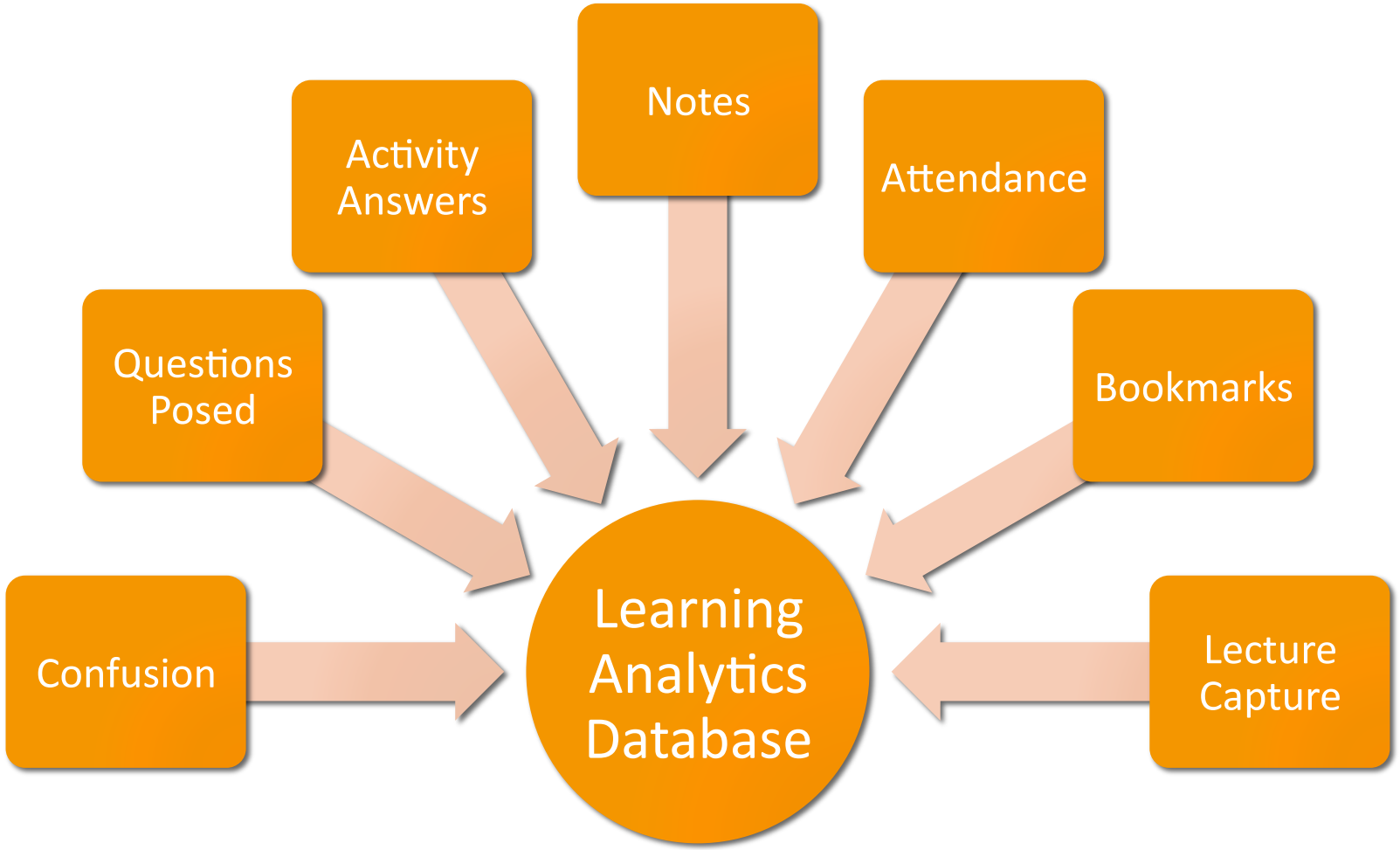
Which air is heavier?

1. Alice Springs, Australia at 35C and 15% relative humidity
2. Singapore at 35C and 85% relative humidity

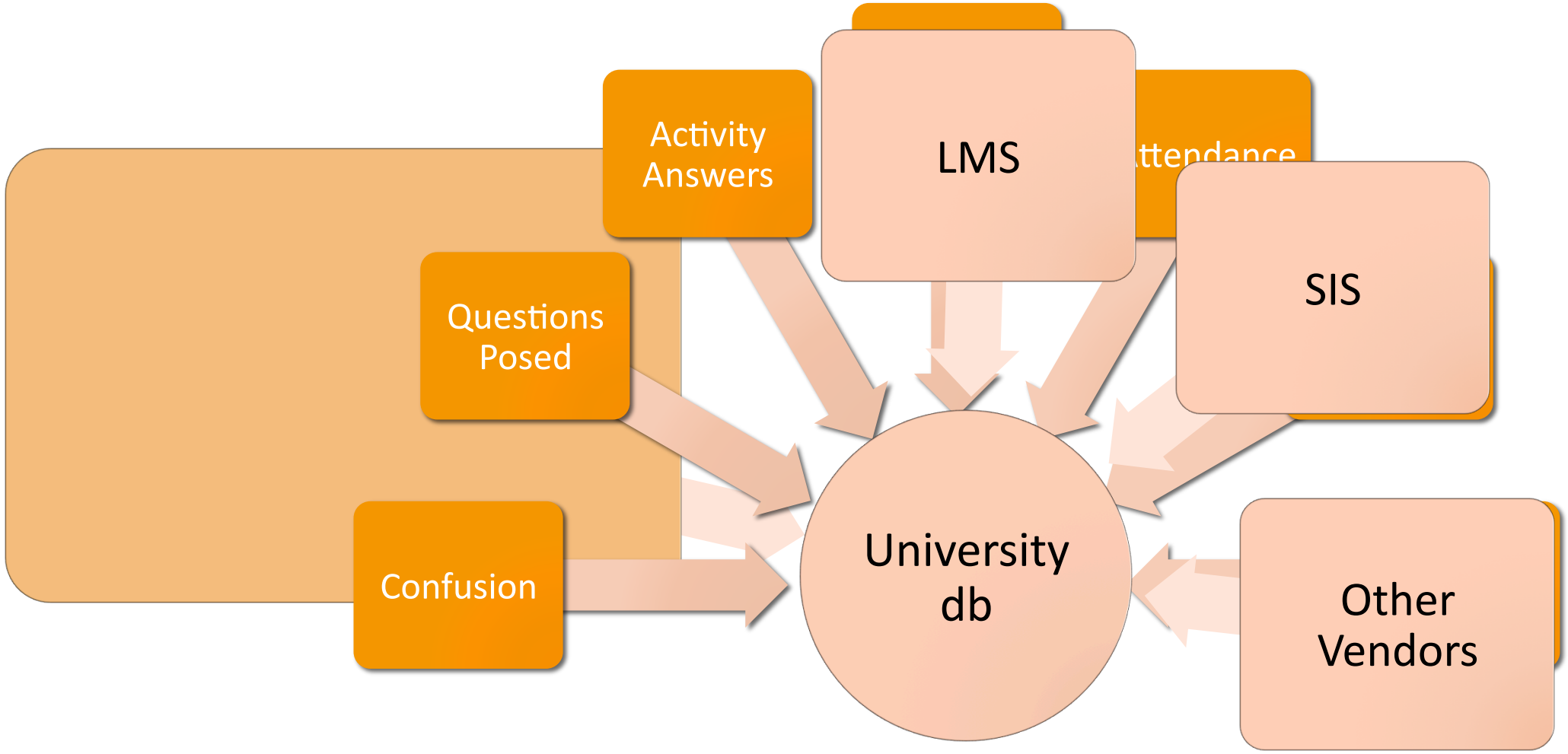
# Image Quiz

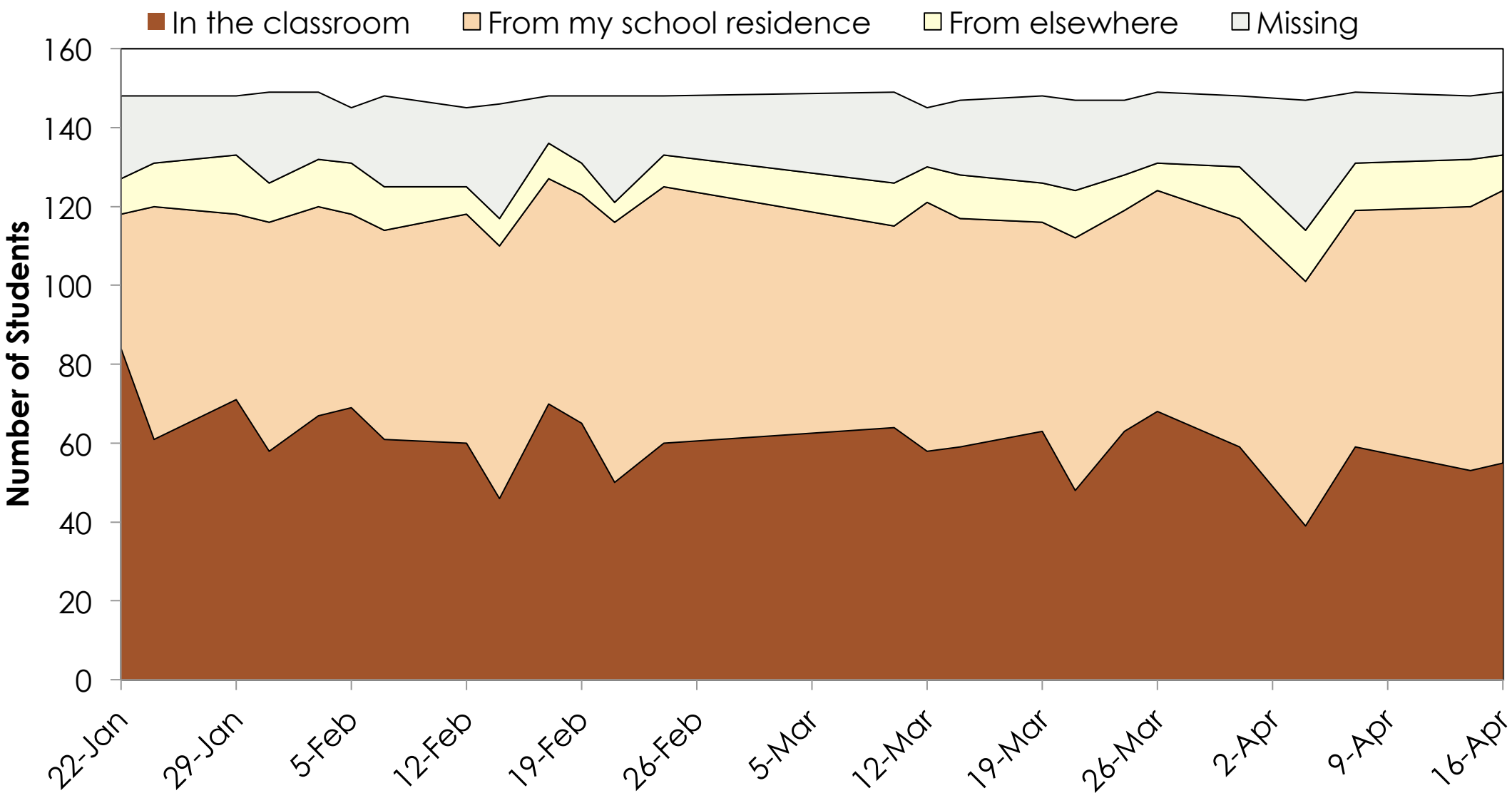
When El Nino happens what part of the Pacific gets much warmer than normal?

# Creating an Ecosystem



# Creating an Ecosystem




In the classroom
From my school residence
From elsewhere
Missing
Number of Students
160
140
120
100
80
60
40
20
0
22-Jan
29-Jan
5-Feb
12-Feb
19-Feb
26-Feb
5-Mar
12-Mar
19-Mar
26-Mar
2-Apr
9-Apr
16-Apr

Number of Students Taking Notes
Average Words Typed per Student
200
150
100
50
Introductions.Objectives
Risk Assessment, Layers + Pre-Test
Atmospheric Origins + Layers
Sun-Earth Relationship
Atmospheric Energy
Uneven Heating
Moisture
Condensation
Extreme Weather on Mars
Space Weather
Atmospheric Stability
Cloud Development
Climate Change: 1. Nature's Part
Climate Change: 2. Greenhouse Gases
Climate Change: 3. Impact on Extreme Weather
General Circulation
Ocean Circulation and El Nino
Geostrophic Wind
Atmospheric Forces + Local Winds
Air Masses + Fronts
Hurricane Formation
Hurricane Morphology
Hurricane Forecasting
Cyclogenesis
Polar Jet Stream Affect on Cyclogenesis
What causes thunderstorms?
What makes thunderstorms severe? What causes hail?
How to read weather maps and interpret the results?
Derecho + Downbursts
Lightning

# Assume You Knew Everything Your Students Did as Part of Class

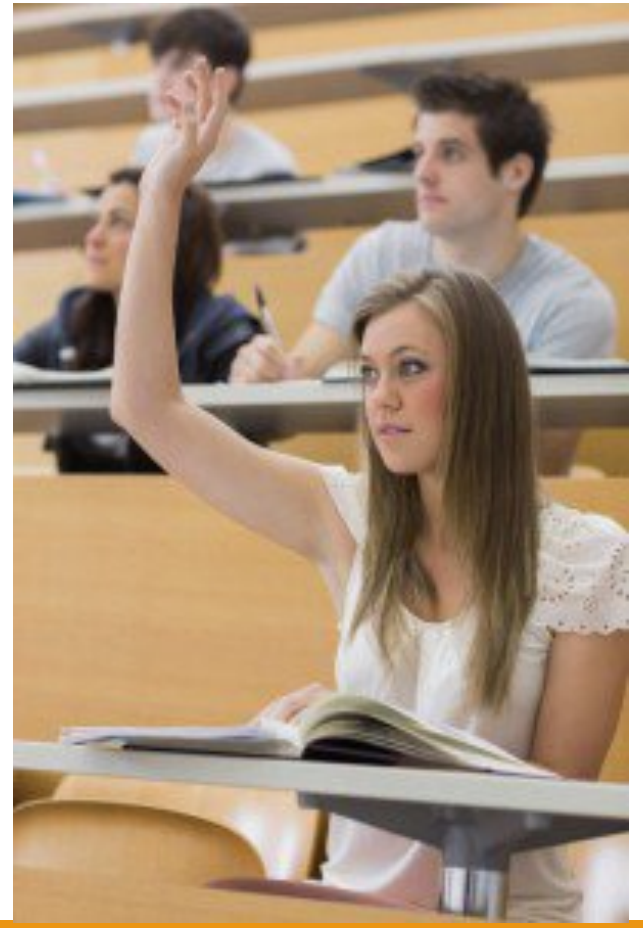
## NOW WHAT?

# Forecasting Student Success

Outcomes = ***b***(background) +
***m***(motivation) +
***p***(participation) +
***l***(life)

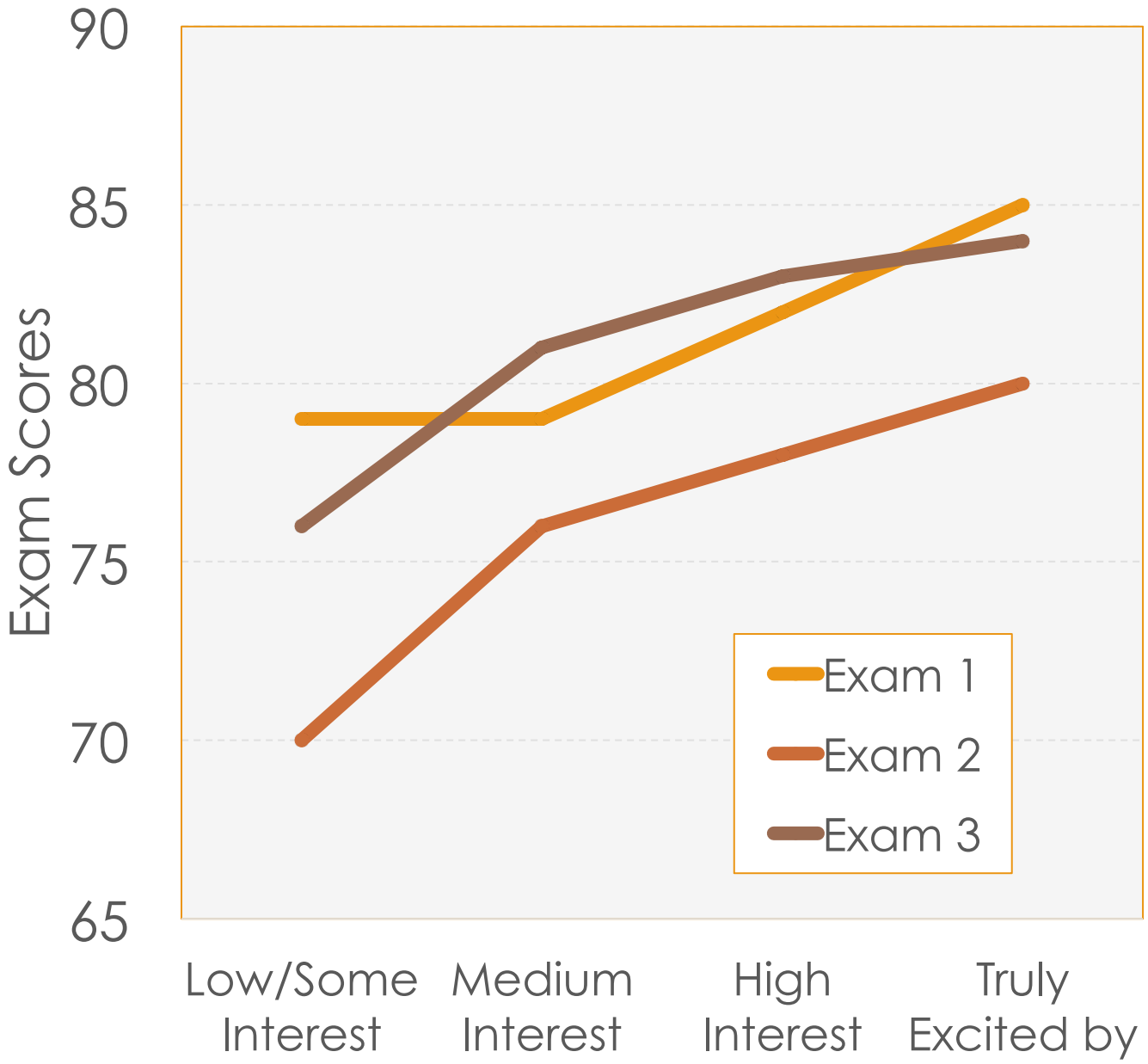
# What Participation Affects Learning?

- Attendance?
- Taking Notes?
- Participating in Discussion?
- Inquiry?
- Answering Questions?
- Other?



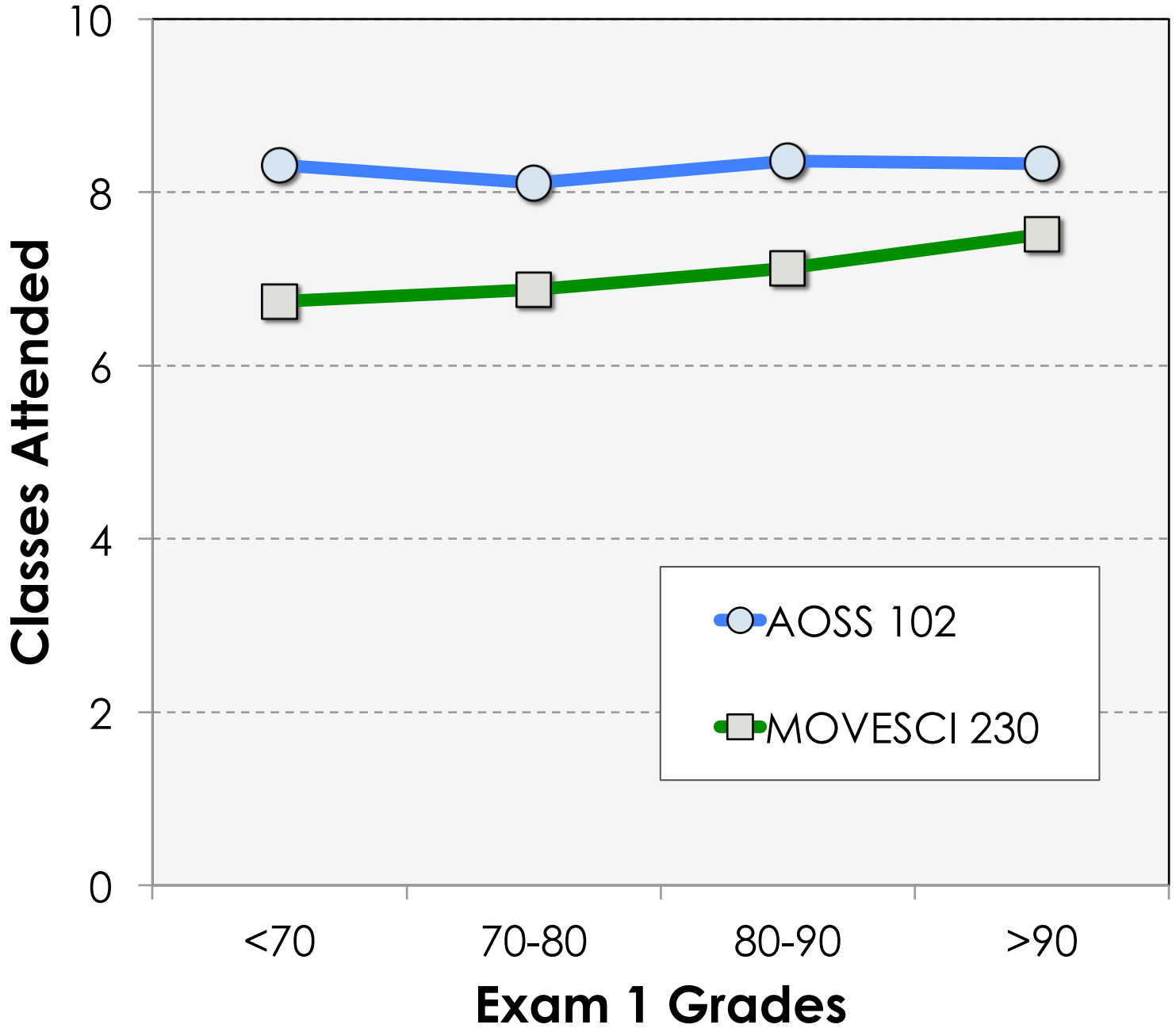
# Multiple Courses: Winter 2015

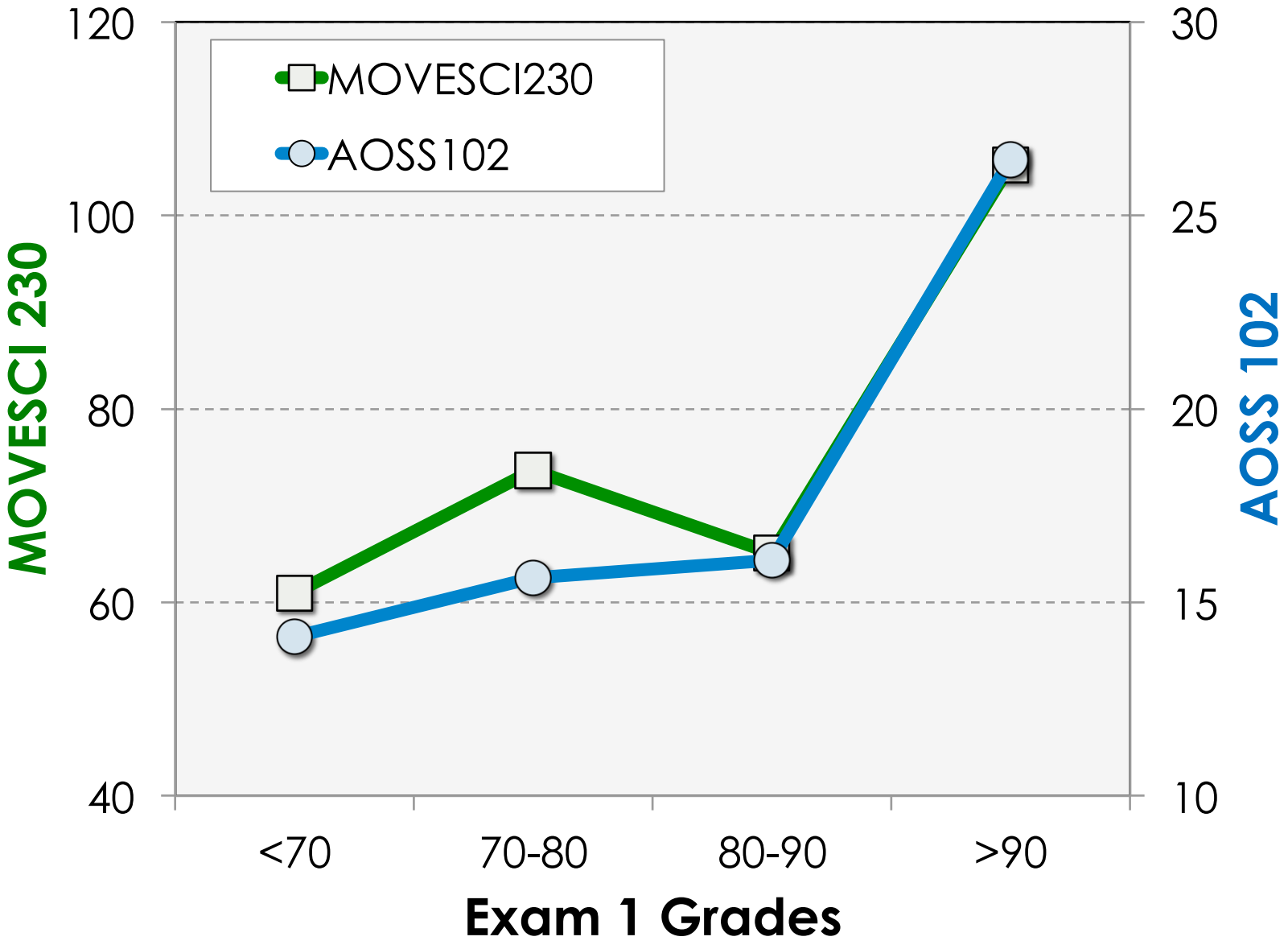
| COURSE | INSTRUCTOR | SIZE |
|---|---|---|
| MOVESCI 230 | M. Gross | 103 |
| AOSS 102 | F. Marsik | 187 |




# Relationship of Student Motivation vs. Grades

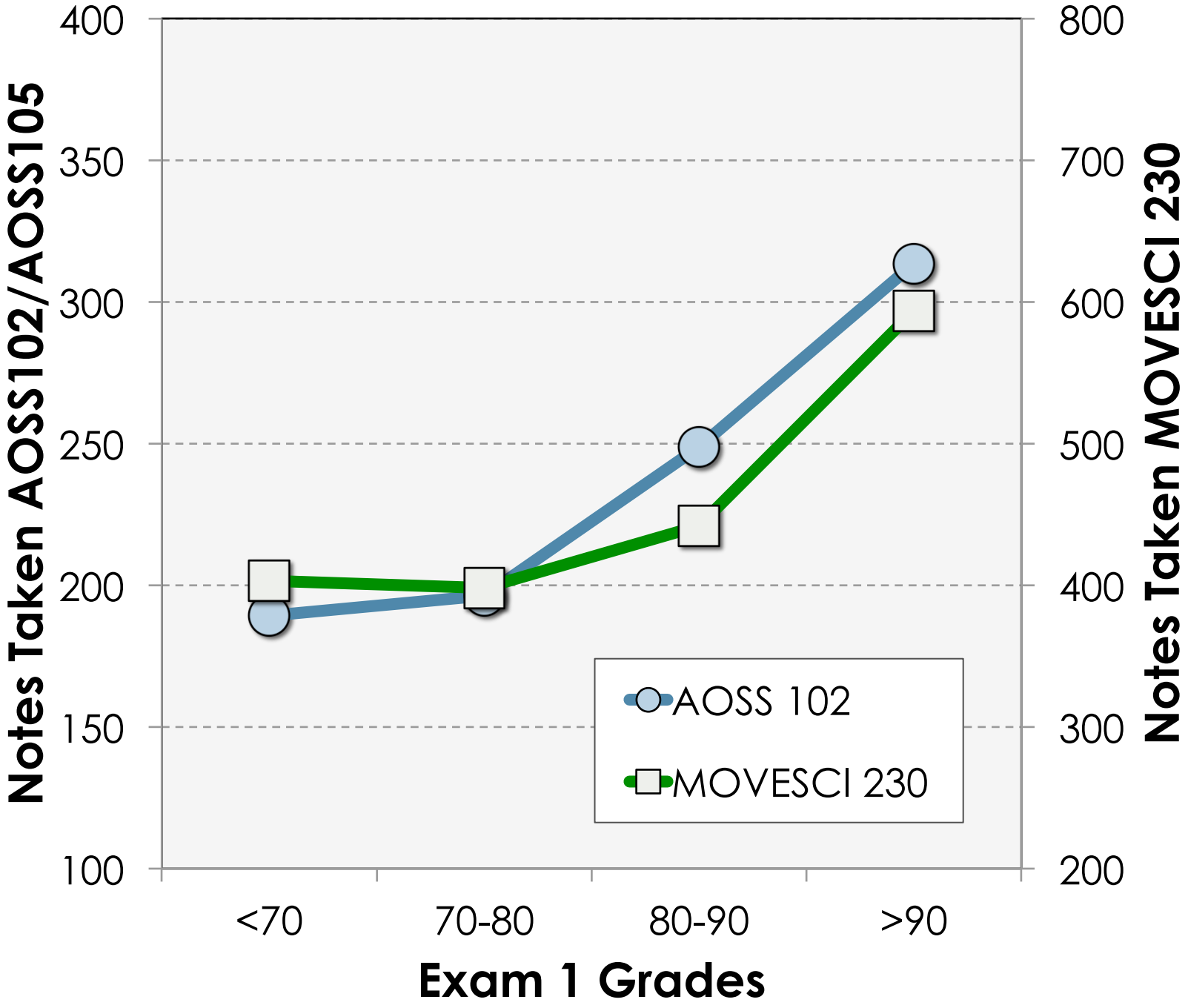
# Relationship of Attendance vs. Grades

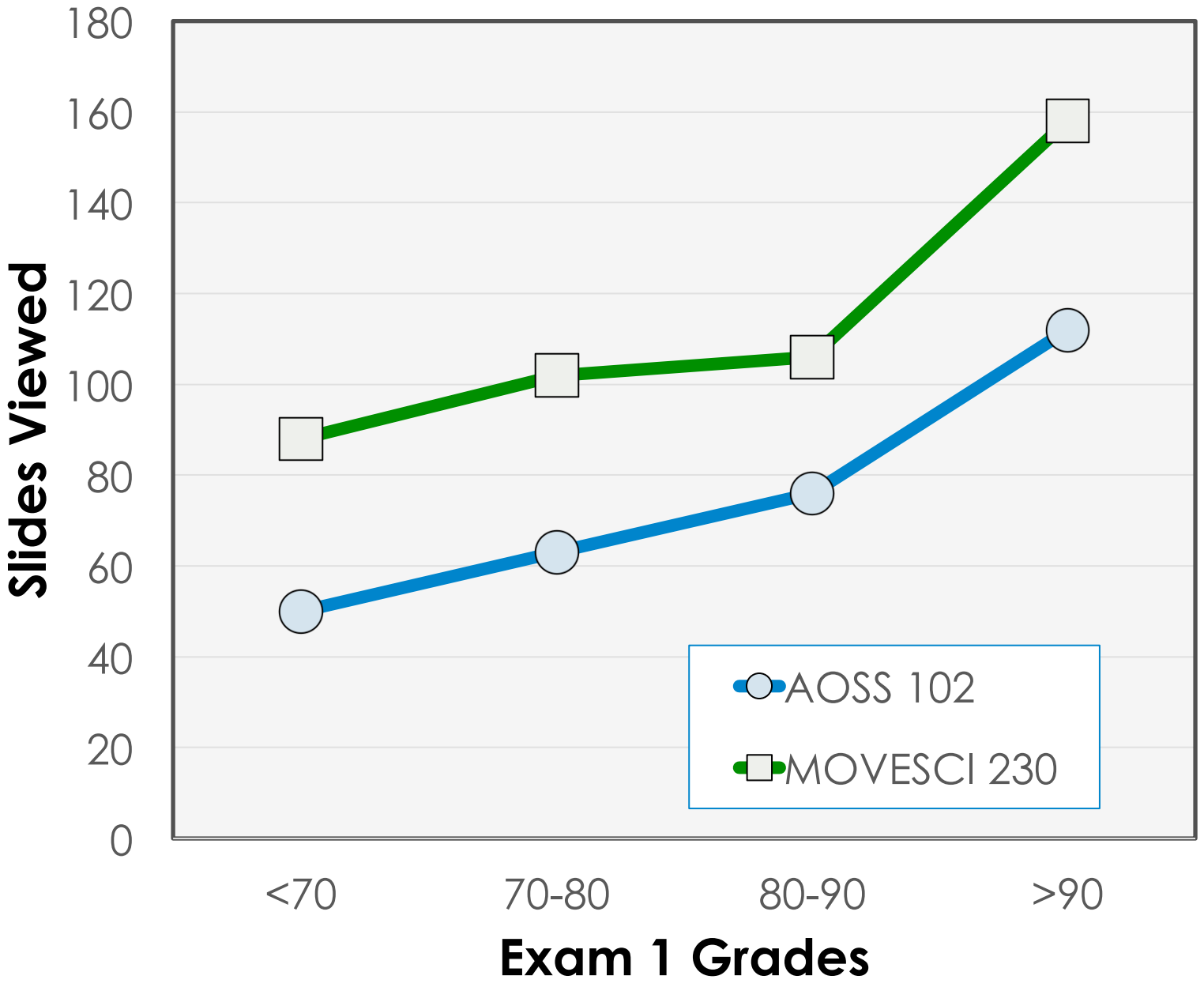




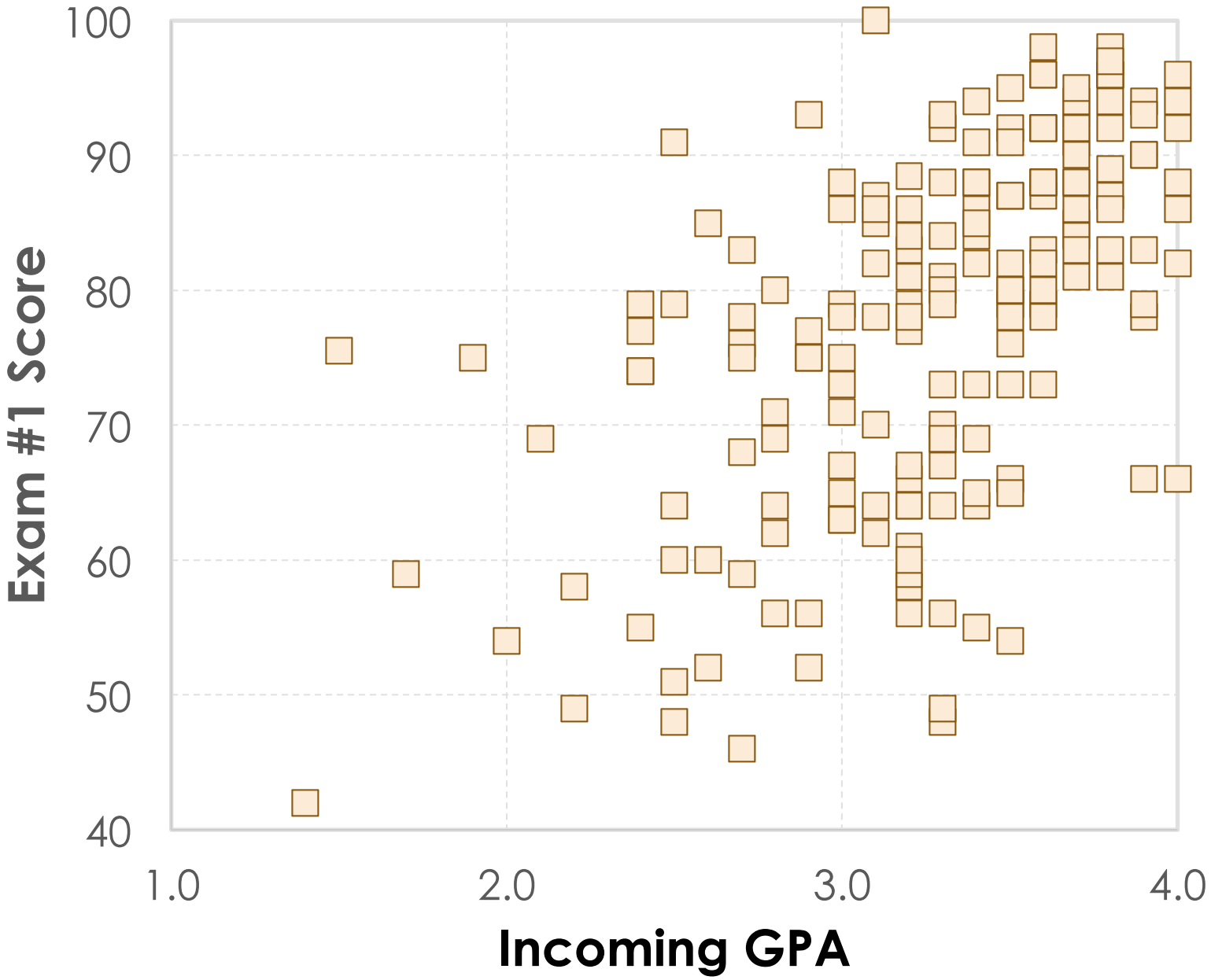

# Relationship of Reviewing Lecture Capture vs. Grades

# Relationship of Note Taking vs. Grades





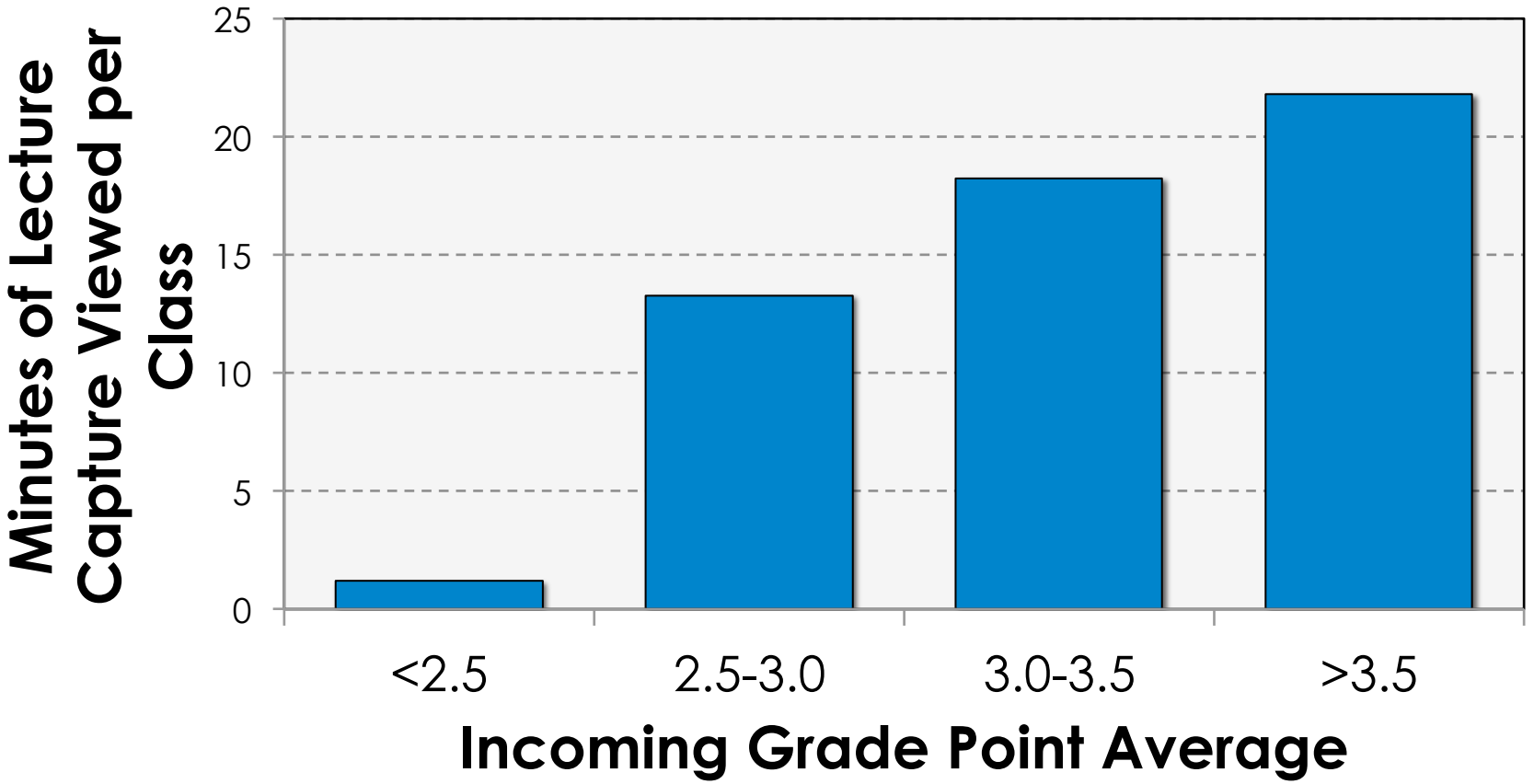

# Relationship of Slide Viewing vs. Grades

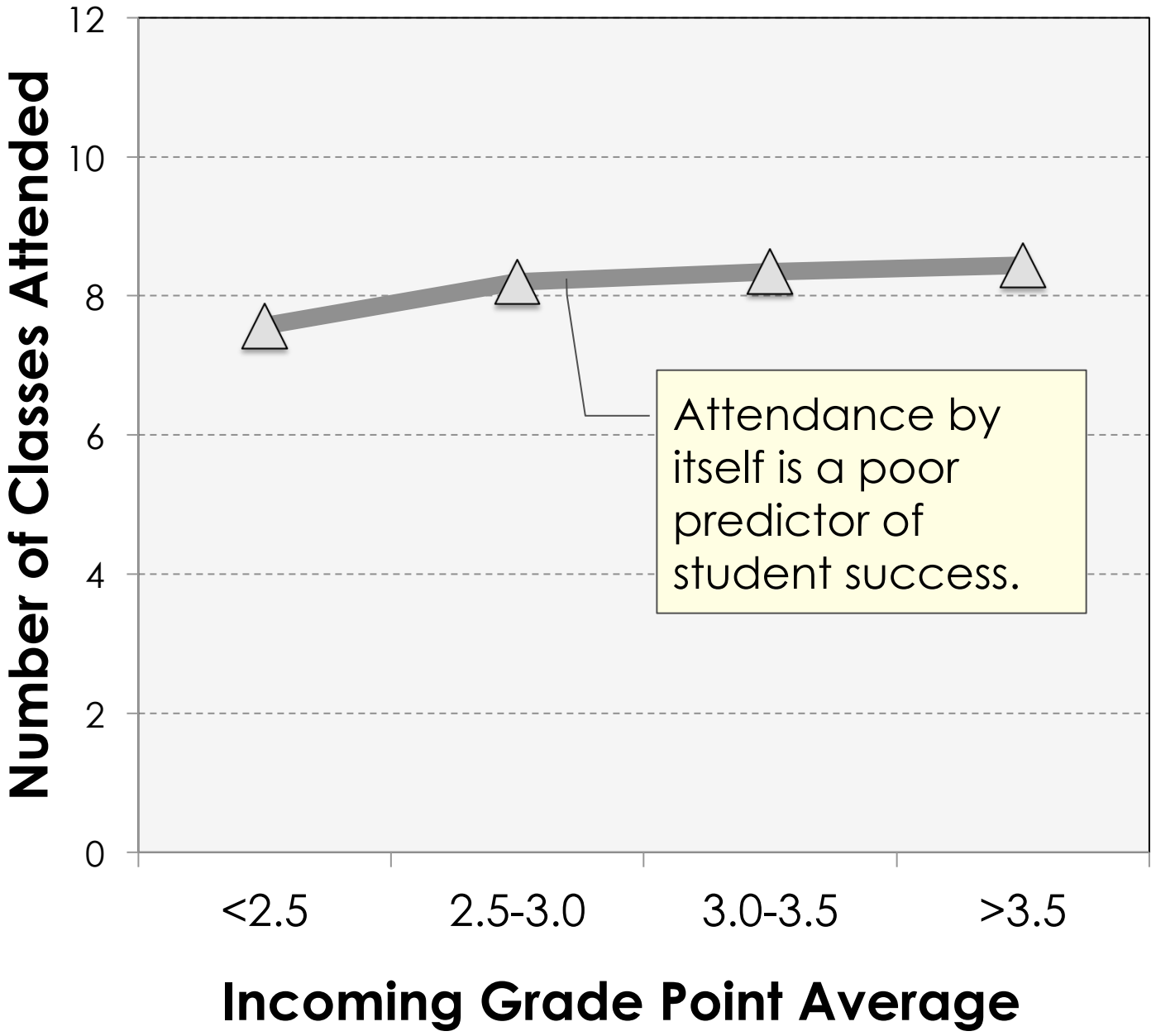

100
90
80
70
60
50
40
Exam #1 Score
1.0
2.0
3.0
4.0
Incoming GPA

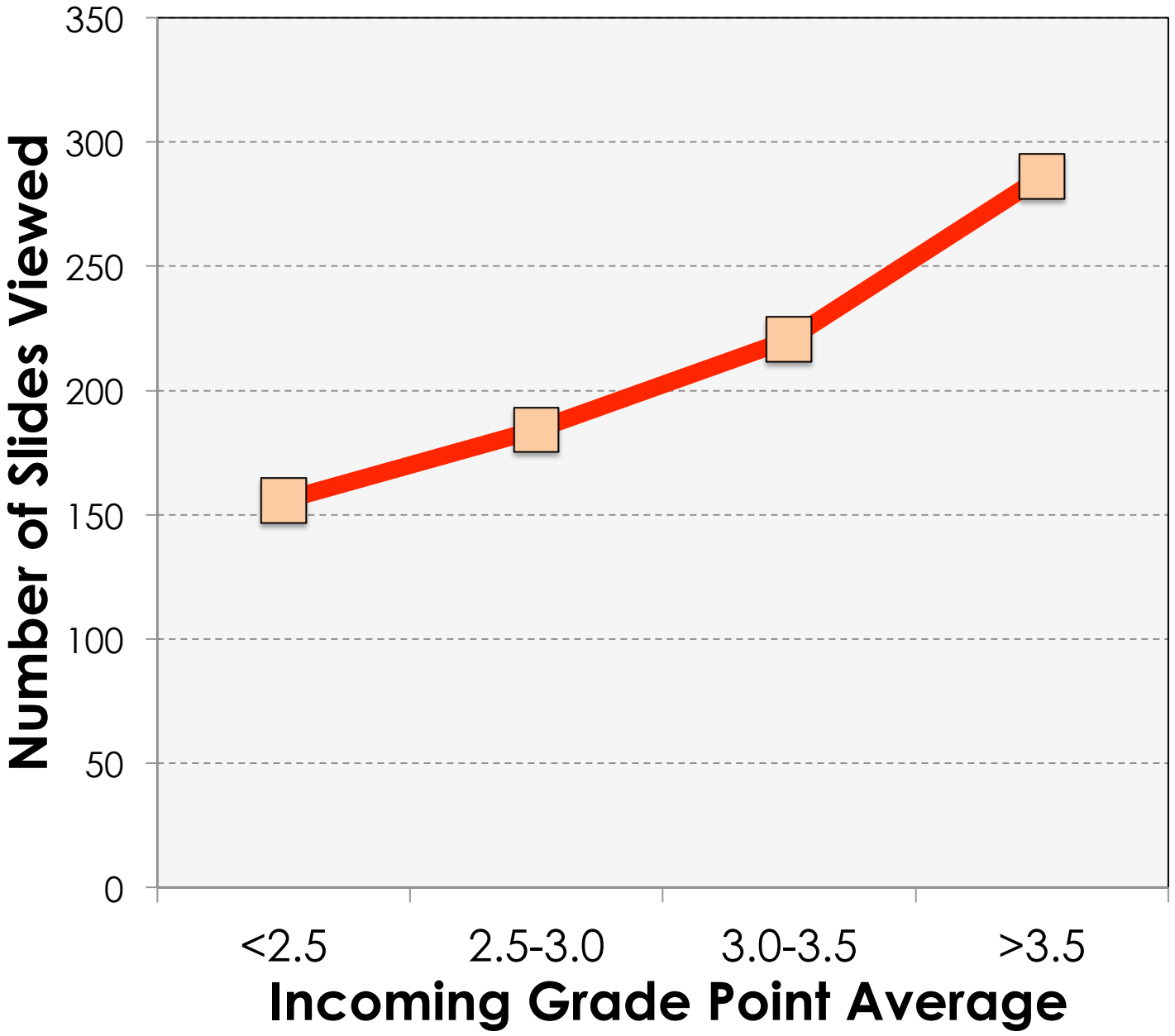
# Do High GPA Students behave Differently from Low GPA Students?

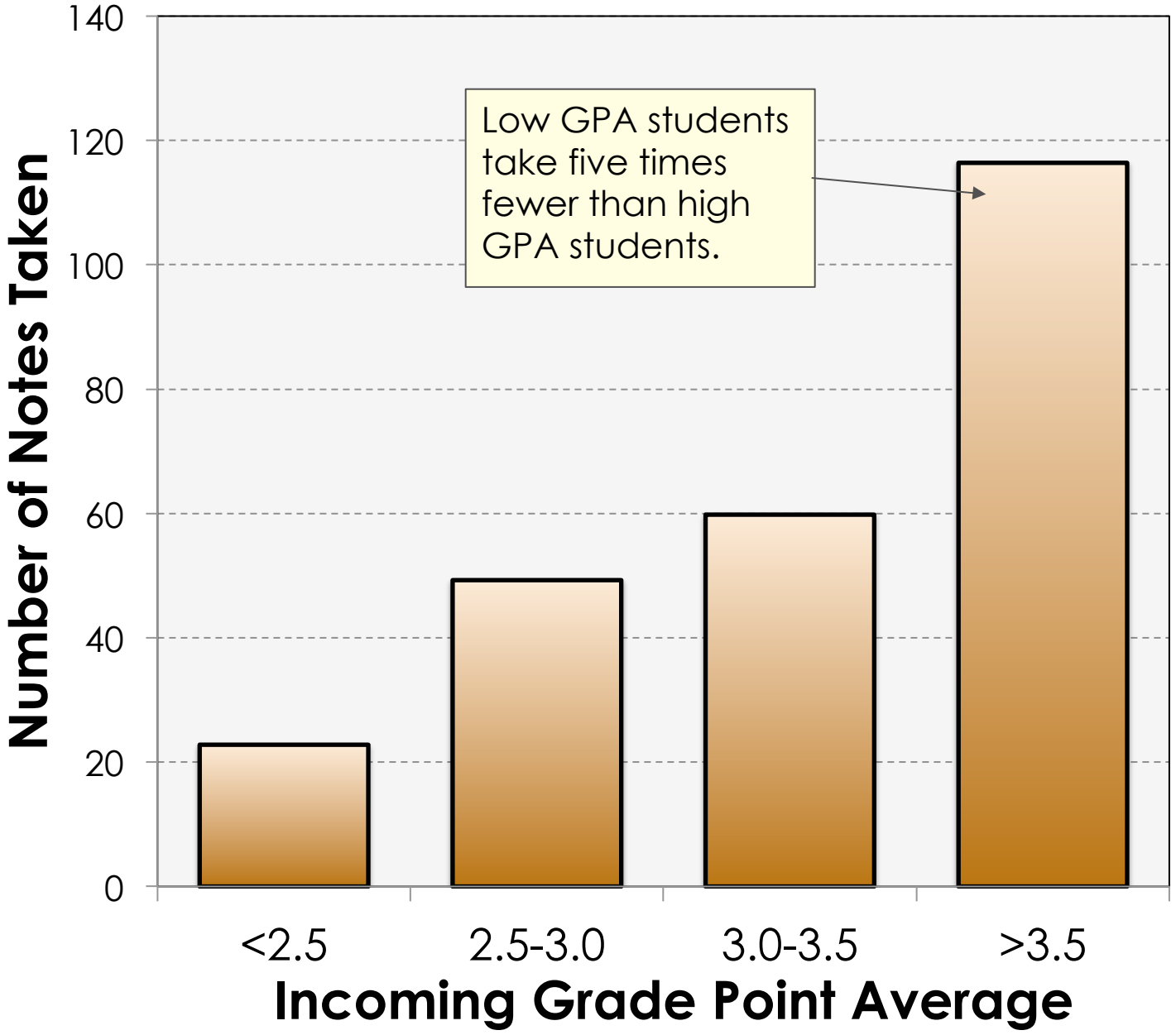
IS IT A DIFFERENCE IN COGNITIVE ABILITY
-OR-
IS IT A DIFFERENCE IN MOTIVATION OR STUDY SKILLS?

# Successful Students Behave Differently




Number of Classes Attended
12
10
8
6
4
2
0
<2.5
2.5-3.0
3.0-3.5
>3.5
Incoming Grade Point Average
Attendance by itself is a poor predictor of student success.


350
300
250
200
150
100
50
0
Number of Slides Viewed
<2.5
2.5-3.0
3.0-3.5
>3.5
Incoming Grade Point Average


Number of Notes Taken
140
120
100
80
60
40
20
0
Low GPA students take five times fewer than high GPA students.
<2.5
2.5-3.0
3.0-3.5
>3.5
Incoming Grade Point Average

# Lessons Learned

1. Student exam scores are related to in-class participation measured as slides viewed, notes taken and more.

   *These terms should be valuable both for predictive analytics and as a basis for development of personalized feedback.*

2. Levels of student participation are related to students' incoming grade point average.

   *This supports the possibility that low grade point students lack motivation or study skills rather than cognitive ability.*

# Thank you

Blog: www.sageonstage.com

Email: samson@umich.edu