USING FORMATIVE ASSESSMENTS IN LARGE LECTURES TO IDENTIFY AND ADDRESS STUDENT MISCONCEPTIONS

Second Annual Assessment Day
April 20, 2016

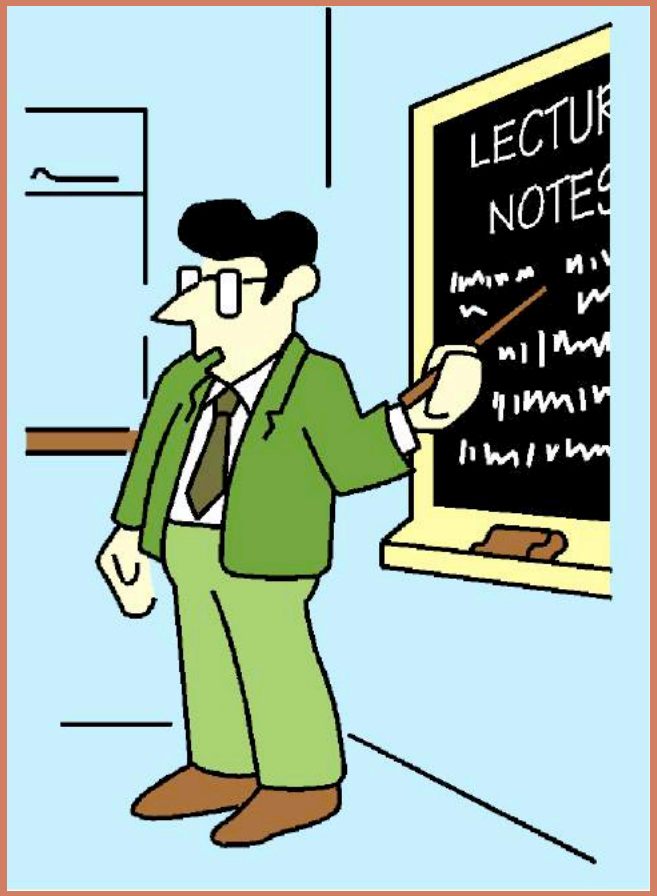
HUNTER

Hunter College
CUNY

Department of Chemistry

Dr. Manashi Chatterjee

LECTURING…



Use
Power Point or
Prezi

Use more
visuals
than words

https://www.insidehighered.com
Crafting an Engaging Lecture, *Ashley Wiersma*

"Tell me and I'll forget; show me and I may remember; involve me and I'll understand."

-Chinese proverb

Teaching and Engaging 400-600 students

Test Based Educational Assessment OR Accountability

(ACS Exams)

Test Vs. Assessment

Test is an "evaluative device or procedure in which a sample of an examinee's behaviors in a specified domain is obtained and subsequently evaluated and scored using standardized process"

(Rights and Responsibilities of Test Takers: Guidelines and Expectations)

AMERICAN PSYCHOLOGICAL ASSOCIATION

Assessment is a "process that integrates test information with information from other sources"

Assessment is a "wide range of methods for evaluating pupil performance and attainment…"

(*Filsecker & Kerres; Practical Assessment, Research & Evaluation 2012*)

Assessment is not a just A "Test"

Formal Exam
Oral Exam
Classroom Based Assessment Helps us Find "How Much of the Learning Outcomes Are Met"

FORMATIVE ASSESSMENT:

TAKES PLACE DURING THE COURSE OF TEACHING AND IS USED ESSENTIALLY TO FEED BACK INTO THE TEACHING/ LEARNING PROCESS.

SUMMATIVE ASSESSMENT:

TAKES PLACE AT THE END OF A TERM OR A COURSE AND IS USED TO PROVIDE INFORMATION ABOUT HOW MUCH STUDENTS HAVE LEARNED AND HOW WELL A COURSE HAS WORKED.

IPSATIVE ASSESSMENT:

IN WHICH THE PUPIL EVALUATES HIS/ HER PERFORMANCE AGAINST HIS/HER PREVIOUS PERFORMANCE.

FORMATIVE ASSESSMENT

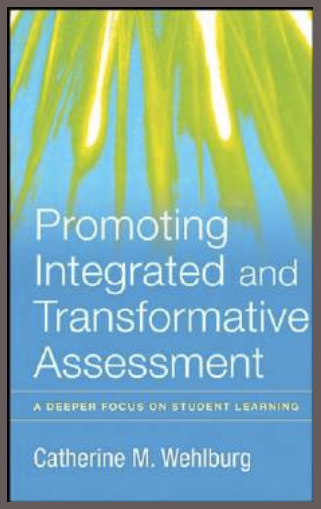
Role of Formative Assessment

A. Rethink the role of assessment so it can help support and document classroom learning

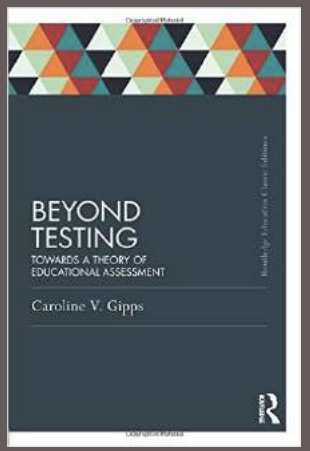
B. Create an integrated and ongoing system for assessment that both prepares for an accreditation visit and truly enhances student learning

C. Reflection of teaching practices to determine if "*Learning Outcomes*" are being adequately met during the "*Process*" of learning using Learner-centered curriculum

D. Engaged active learning environment



Testing Culture to Assessment Culture



How to Engage Students?

A. Instructor *stops lecturing* and students work on a question or task designed to help them understand a concept

B. Creating "***Think Moments" and "Encourage Peer Instruction"***

C. Students are generally passive observers instead of being active participants required for learning

Finding ways to replace lectures with more engaging activities – low and high tech

THE STUDENT SHOULD DEVELOP SKILLS OF ANALYSIS, SYNTHESIS, CRITICAL THINKING, PROBLEM SOLVING

-

LARGELY VIA SCIENTIFIC METHOD.

http://assessment.uconn.edu/primer/goals1.html

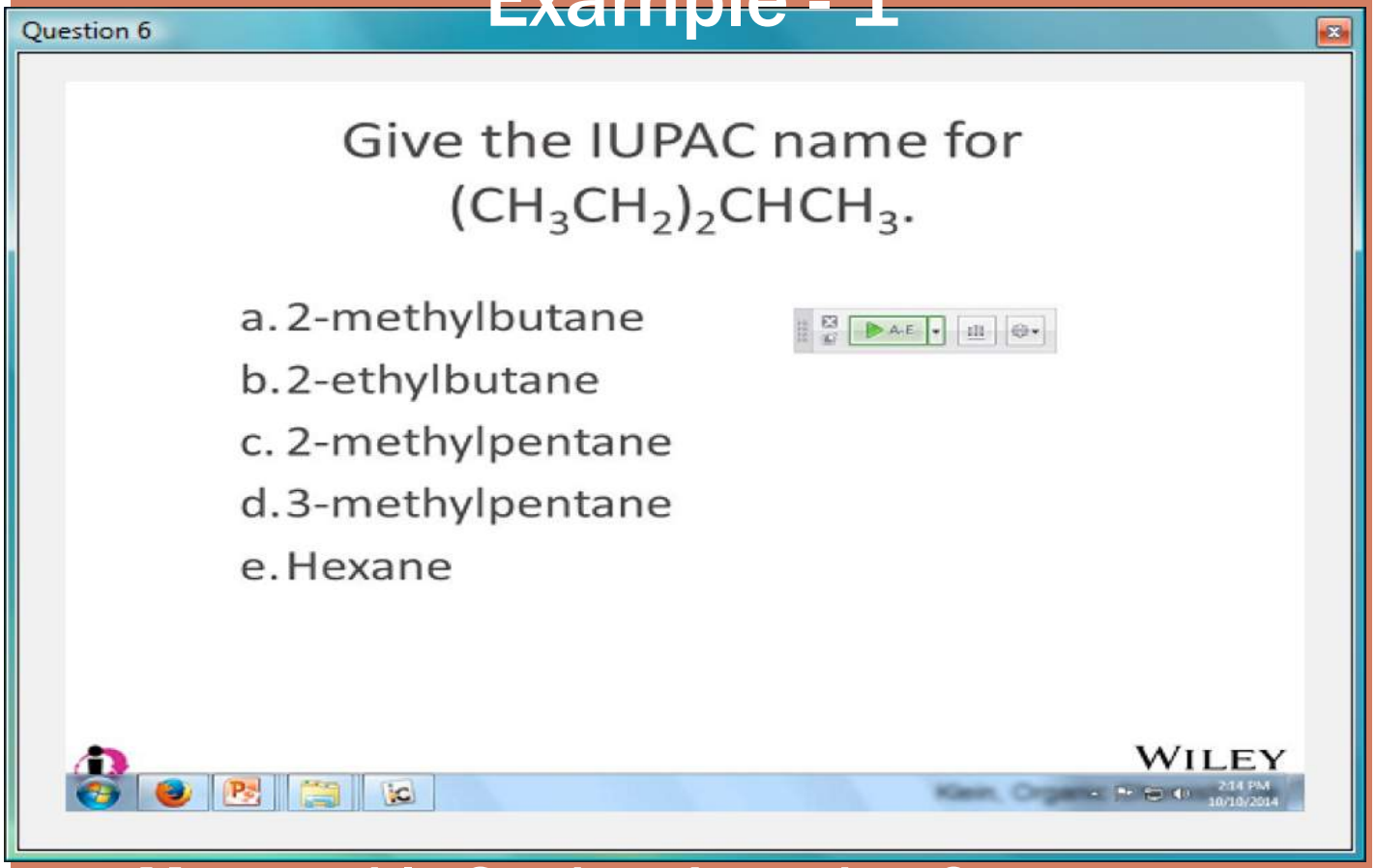
COURSE LEARNING OBJECTIVE

How to Assess?

1) Course Grades

(2) ACS exams Organic

FORMATIVE ASSESSMENT
Example - 1

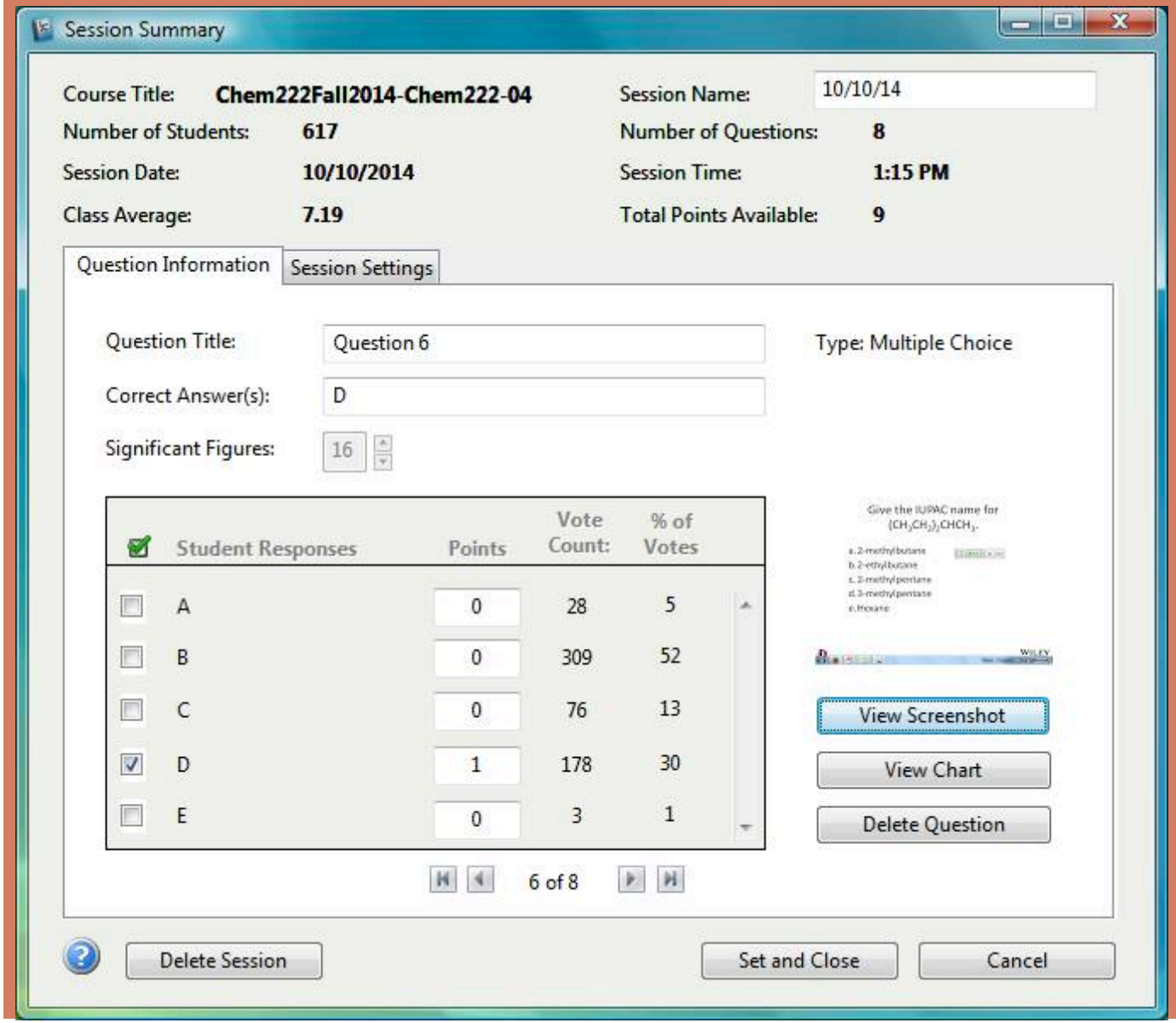


Measurable Student Learning Outcomes:
Students should be able to demonstrate how to use the IUPAC rules by close examination of a given structure

Clicker Question

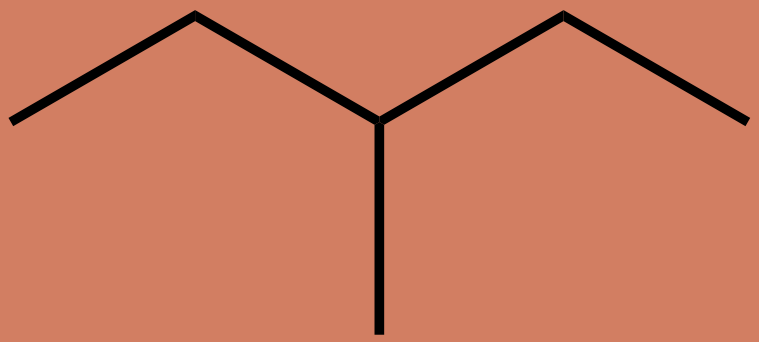
Requires converting condensed structure to line structure

Allows instructor to collect valuable formative assessment information from student response



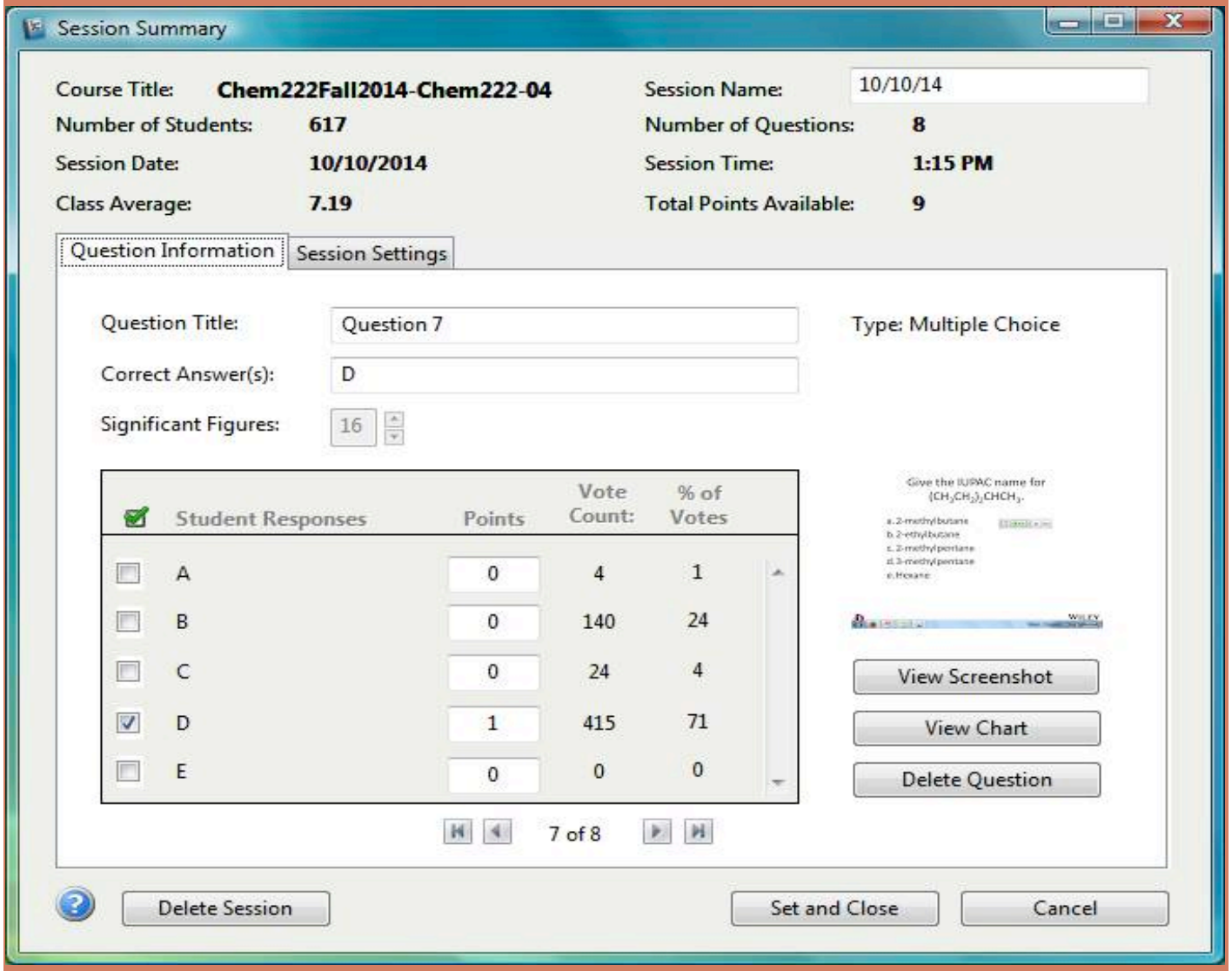
1st Attempt

30% correct



3-methylpentane

FORMATIVE ASSESSMENT
Example - I



Peer Instruction

2nd attempt

71% Correct

SUMMATIVE ASSESSMENT
Example - I

Give the IUPAC name for $(CH_3CH_2)_2CHCH_3$.

a. 2-methylbutane

b. 2-ethylbutane

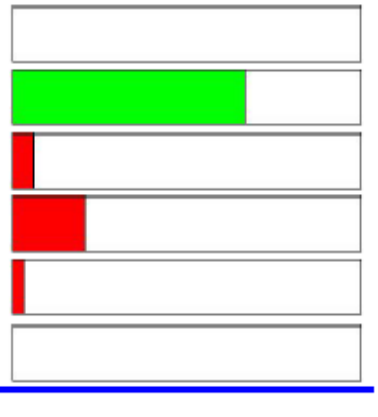
c. 2-methylpentane

d. 3-methylpentane

e. Hexane

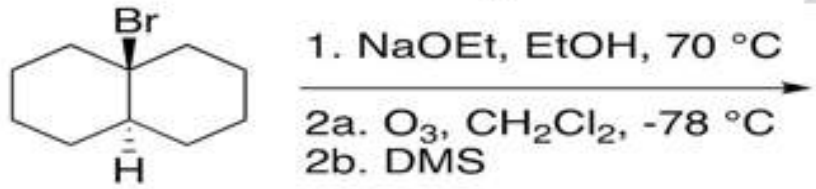
Exam Question

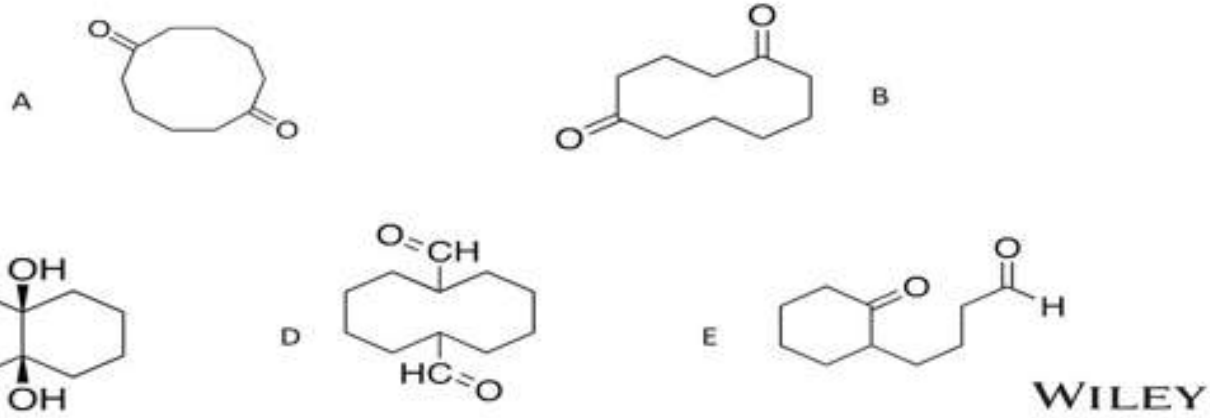
Response	Frequency	Percent
E	1	0.29
* ***D***	228	67.26
C	24	7.08
B	72	21.24
A	14	4.13
Missing	0	0.00



FORMATIVE ASSESSMENT Example - II

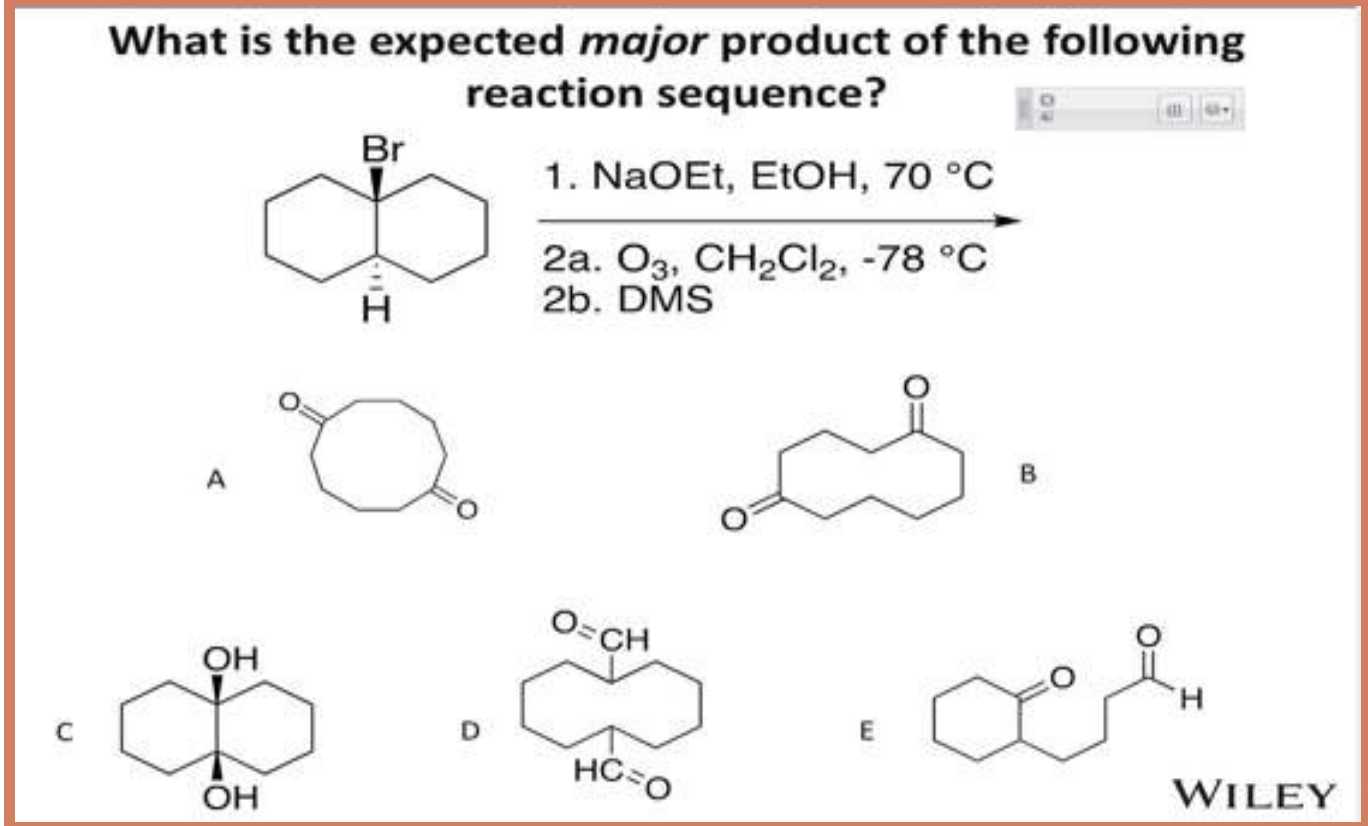
What is the expected *major* product of the following reaction sequence?



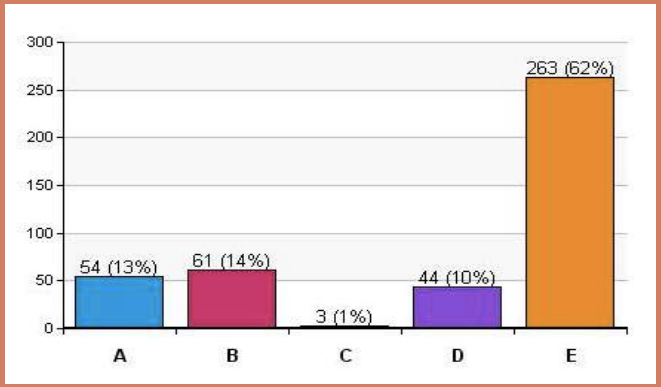


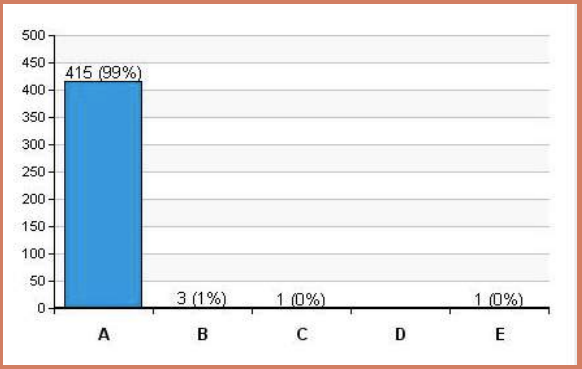
Measurable Student Learning Outcomes:
Students should be able to identify products from multi-step synthesis through the critical analysis of reagents, reaction conditions and reaction mechanisms

Clicker Question



FORMATIVE ASSESSMENT





1st Attempt

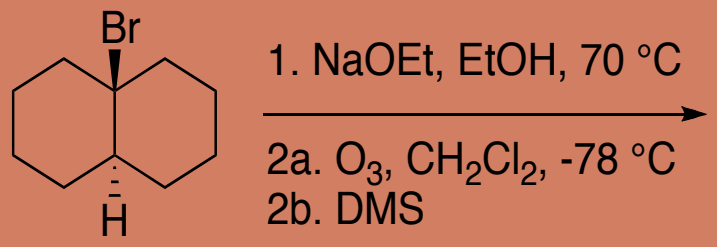
13 % correct

WHY ???

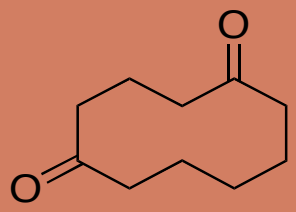
Rote memorization

From Similar Online HW Qs

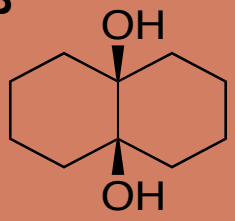
SUMMATIVE ASSESSMENT
Example - II



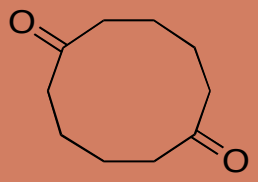
A



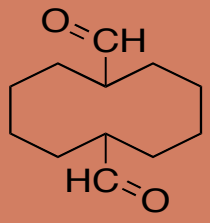
B



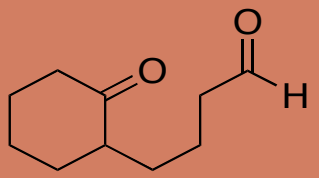
C



D



E



Exam Question

Chem 224

Condensed Item Analysis Report- 224-Spring 2016 - Exam-1

Response	Frequency	Percent
E	91	46.19
D	5	2.54
* C	86	43.65
B	3	1.52
A	11	5.58
Missing	1	0.51

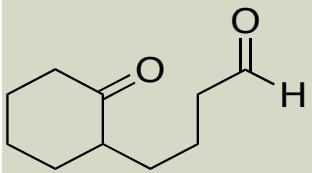
Condensed Item Analysis Report- 224-Spring 2015 - Exam-1

Response	Frequency	Percent
E	124	54.63
D	3	1.32
* C	91	40.09
B	5	2.20
A	3	1.32
Missing	1	0.44

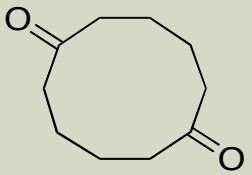
Exam Question Chem224

Condensed Item Analysis Report- Final- Chem 222- Fall 2015

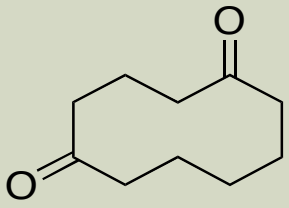
Response	Frequency	Percent
E	8	3.16
D	8	3.16
C	40	15.81
* **B**	133	52.57
A	59	23.32
Missing	5	1.98



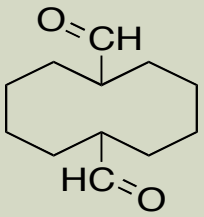
A



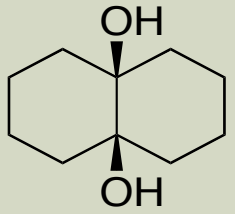
B



C



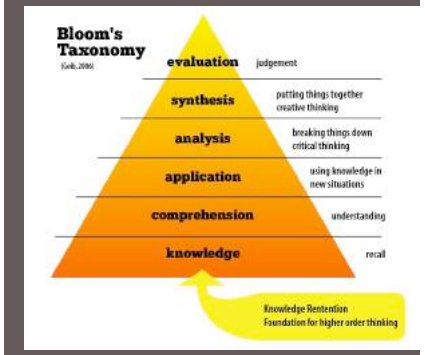
D



E

FORMATIVE ASSESSMENT BEYOND MULTIPLE CHOICE

Studies have previously shown that though many students can successfully pick the correct answer from a number of available options, their understanding of how to actually construct structures is limited



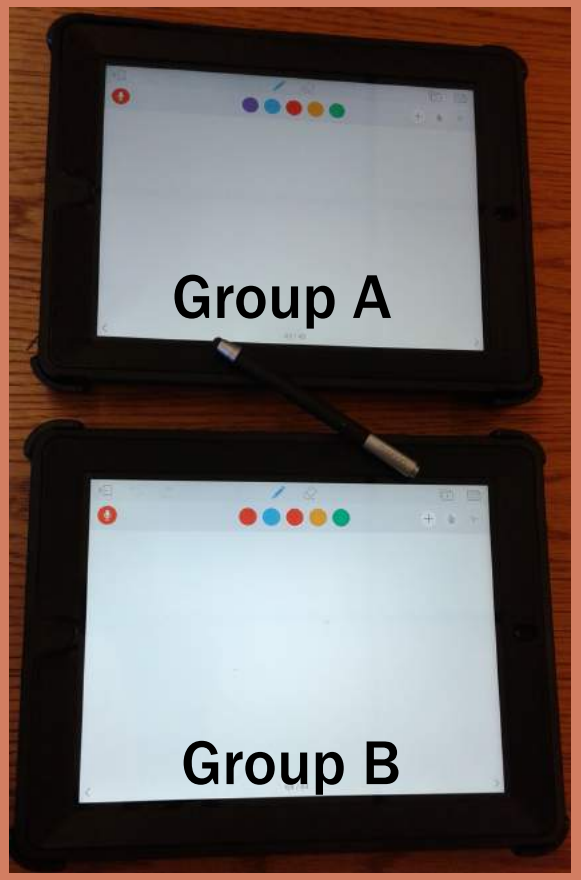
SHORTCOMINGS OF PRS USAGE ALONE

A. Answering multiple choice question correctly does not always indicate deeper level of understanding

B. Provides feedback to instructor that students are getting it wrong, but does not provide feedback on HOW or WHERE students are going wrong

C. There is very little opportunity to point out to student the specific mistakes they made in the problem-solving process that led to their wrong answer

FINDING INNOVATIVE WAYS TO EVALUATE STUDENT WORK



Group C

Educreations App

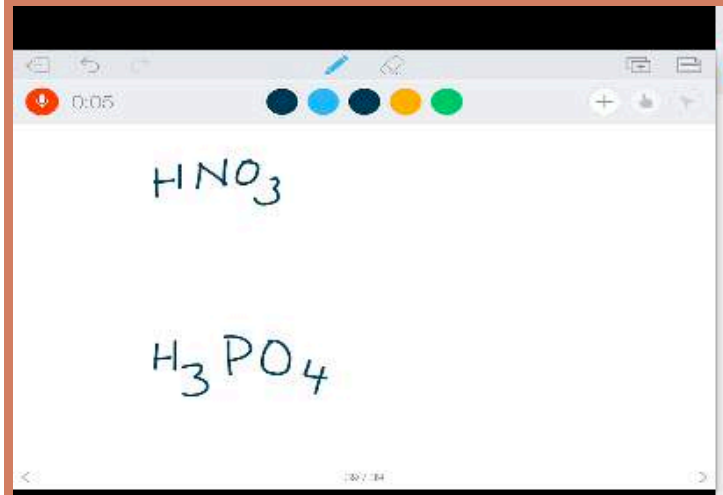
WiFi

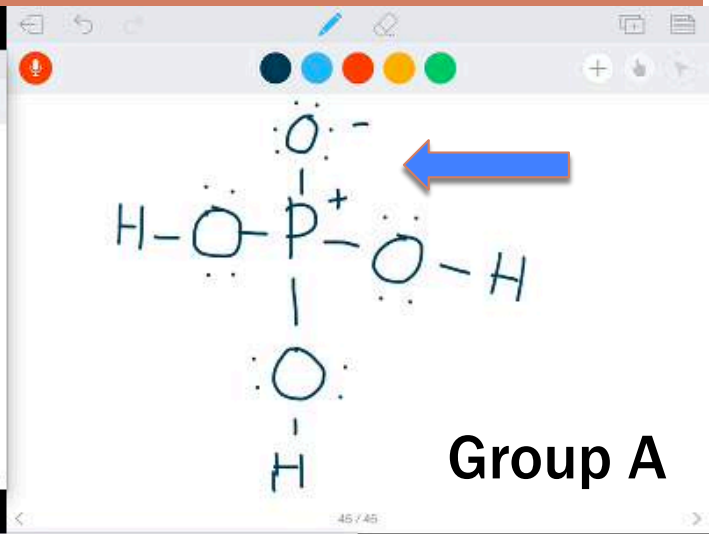
iPads

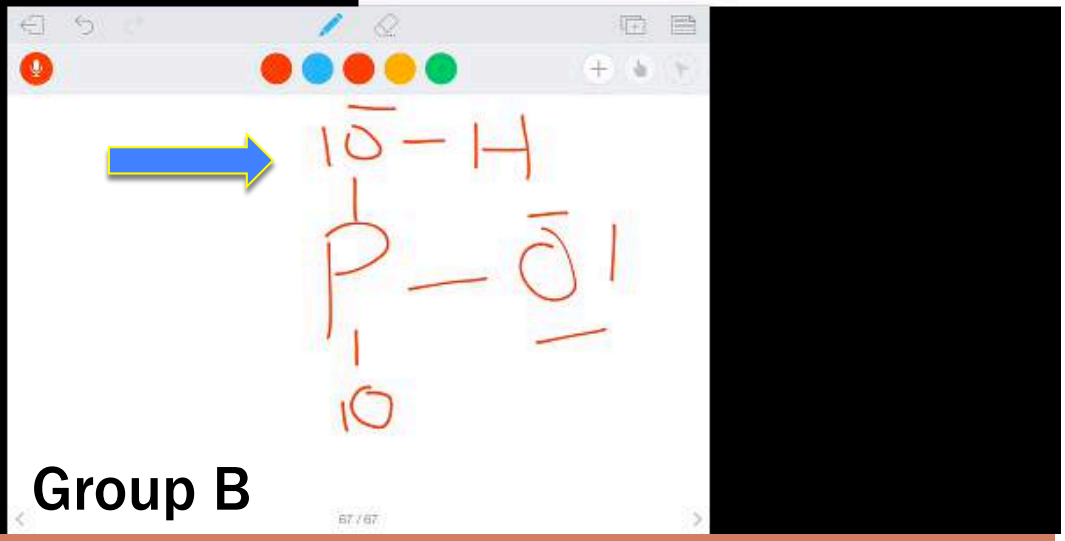
MacBook with AirServer

Peer Mentors

Student Directed Teaching Example – I







Drawing

Lewis Dot Structure

AIRSERVER

TO

PROJECT/ MIRROR

STUDENT WORK

Peer Mentors

Handing out iPads

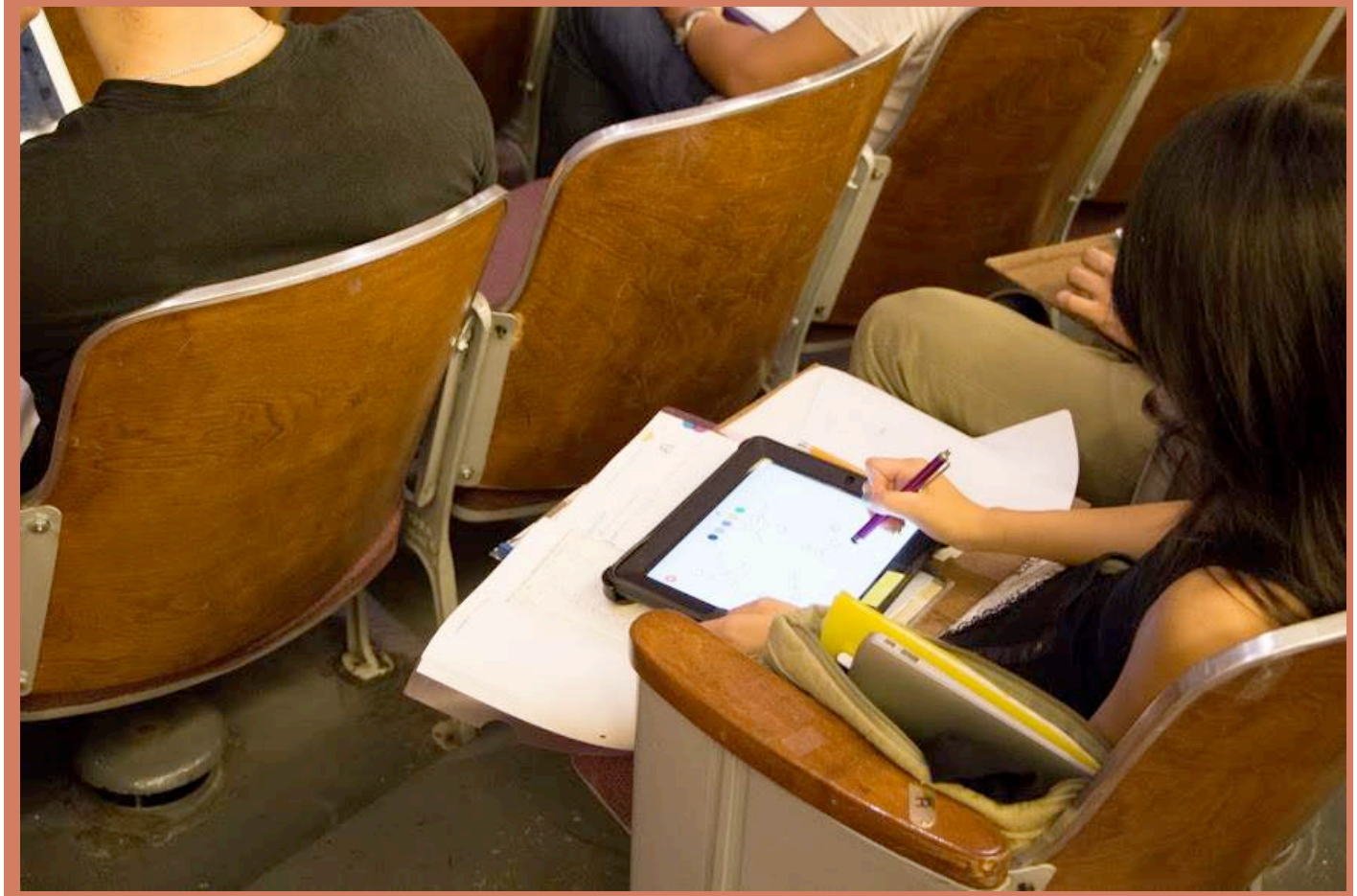
Engage

Explore

Explain

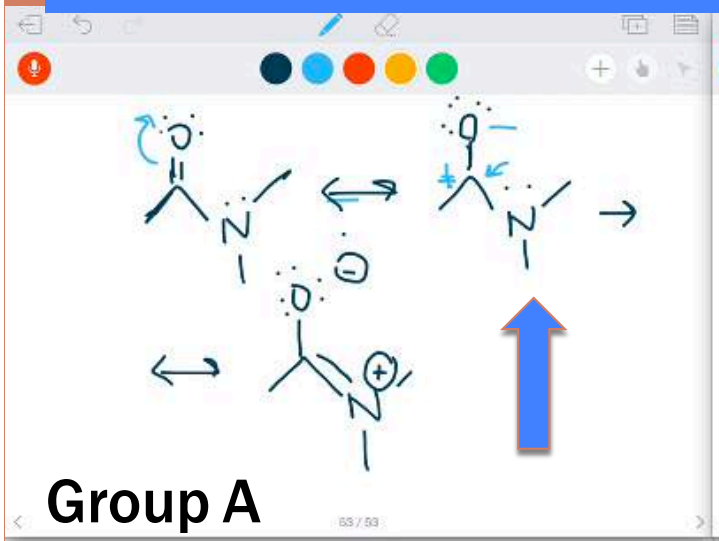
Elaborate

Evaluate

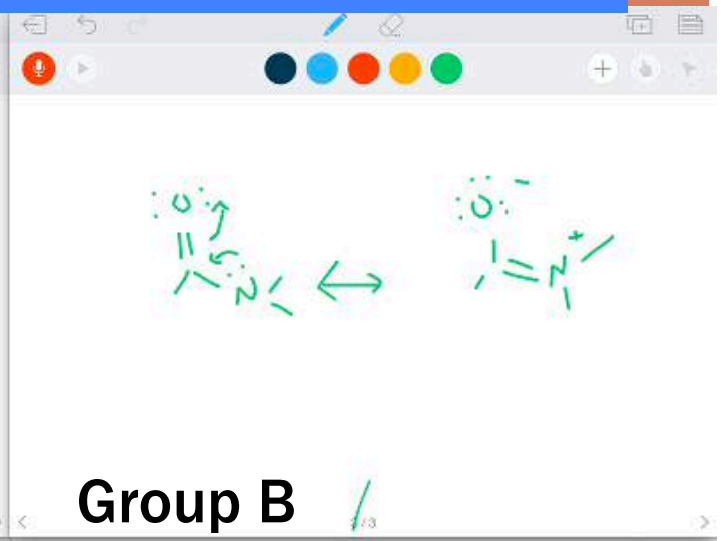


Student Volunteer's are encouraged to construct knowledge through in-class discussion with peers and peer mentors

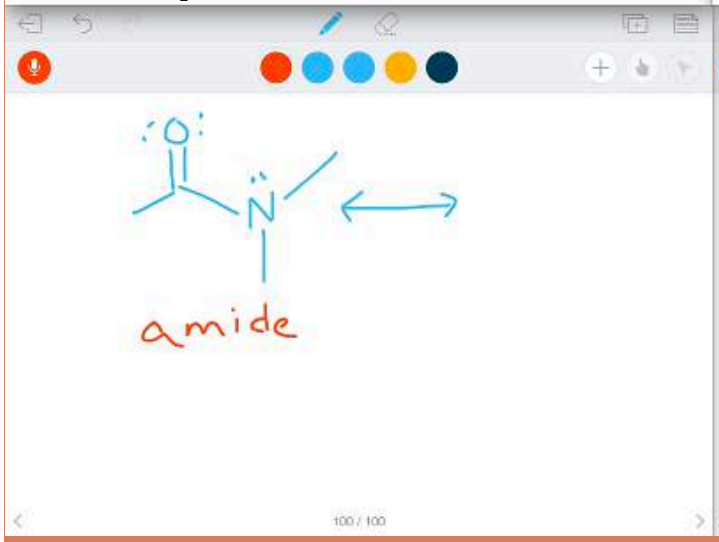
Student Directed Teaching Example – II

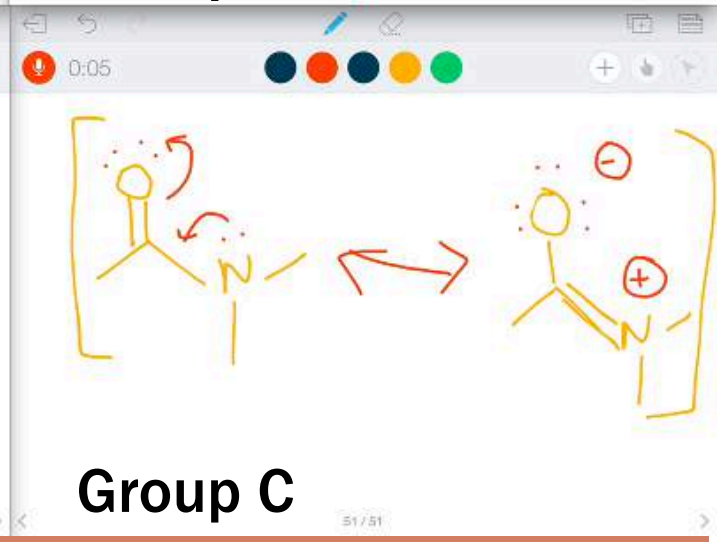


Group A



Group B



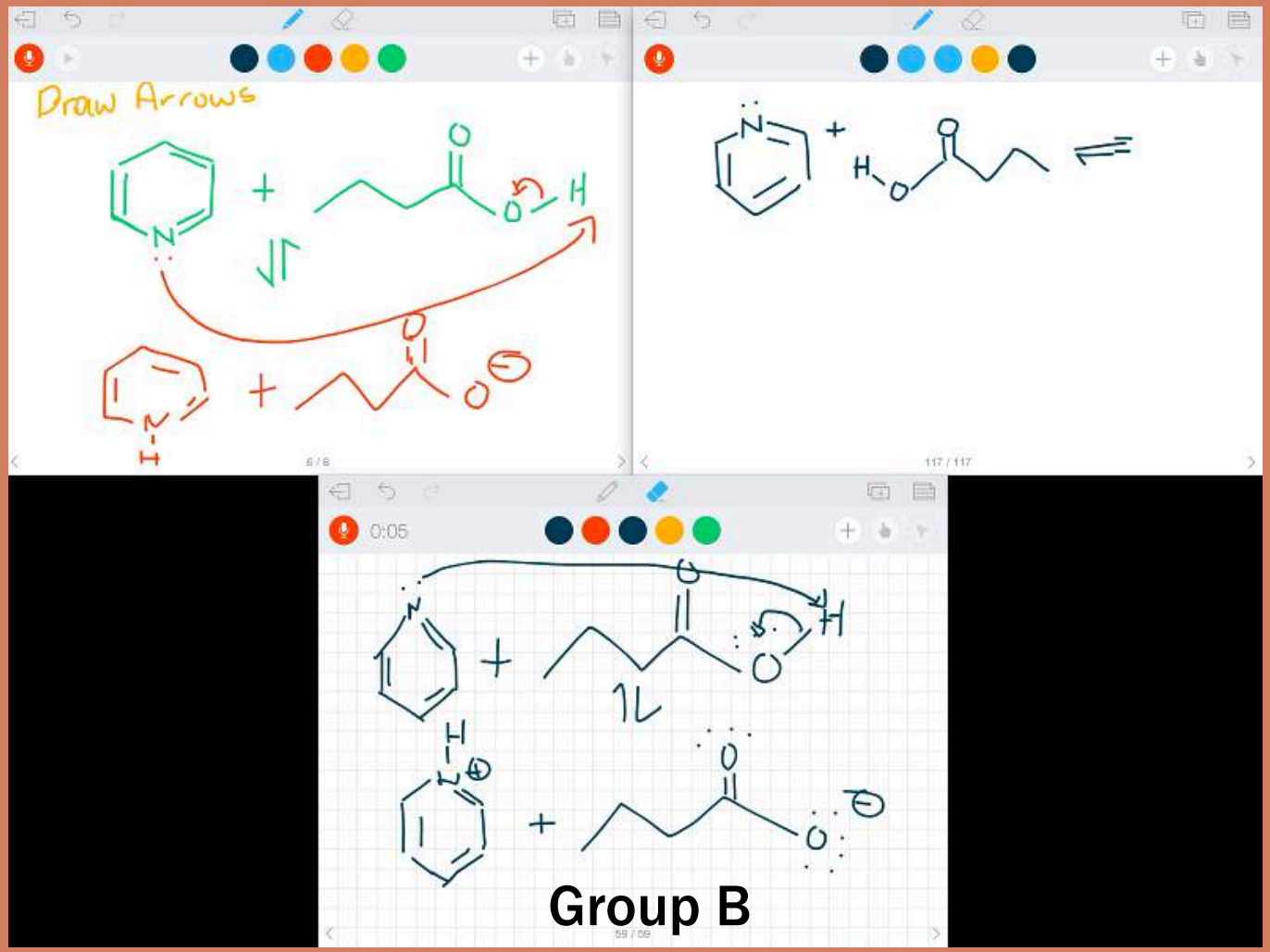


Group C

Resonance

Student Directed Teaching Example – III

Group A- Missing formal charge

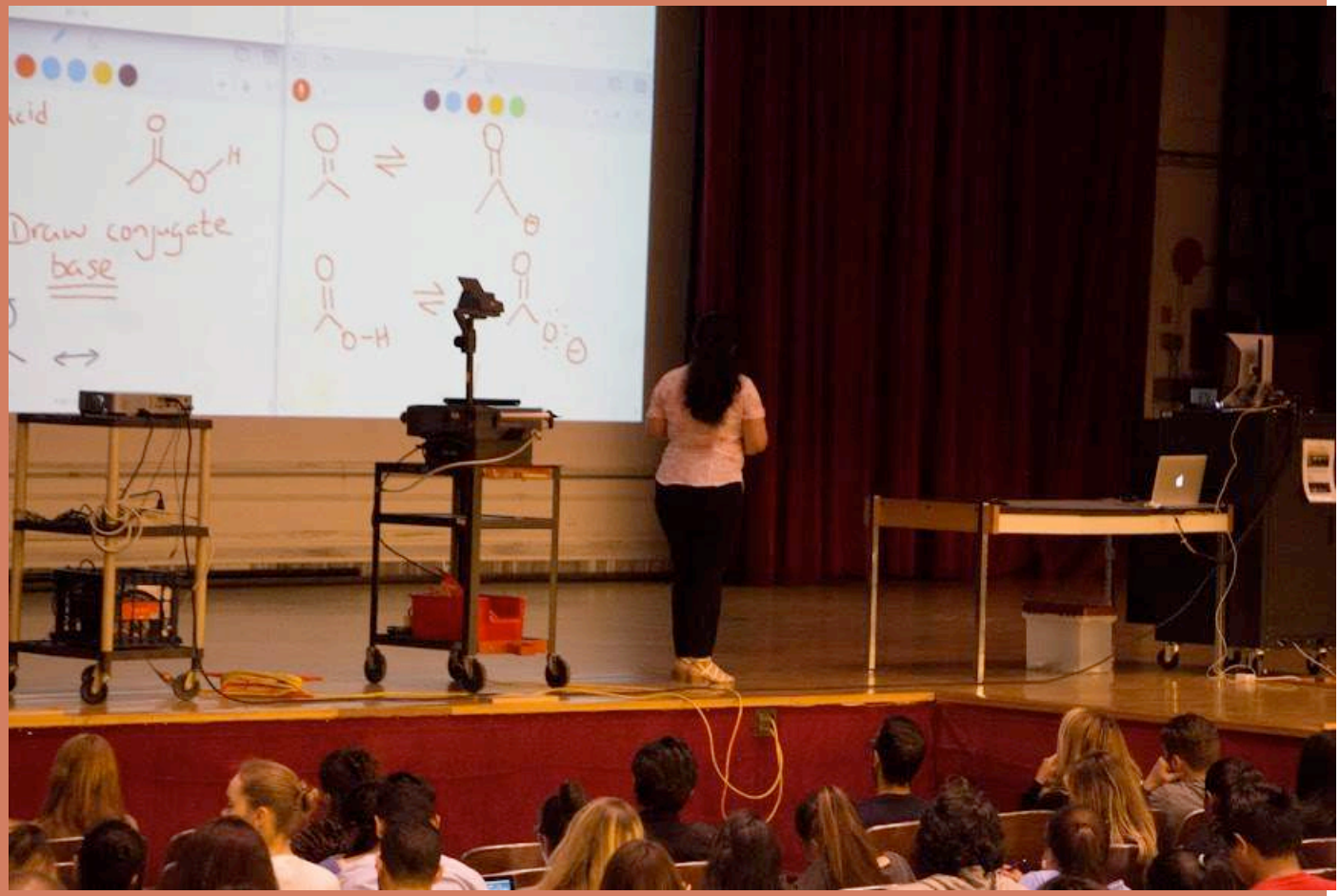


Acid-Base Reactions

Providing formative Assessment

Helps Reinforce Conceptual Understanding

AIRSERVER TO PROJECT/MIRROR STUDENT WORK



Drawing Correct Lewis Dot Structure

Acid-Base Reactions

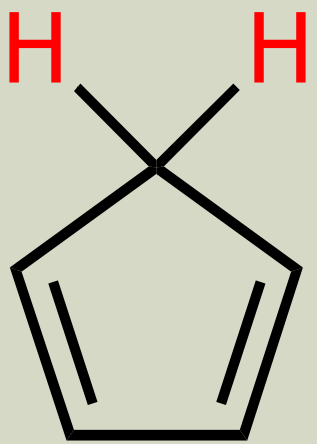
Resonance

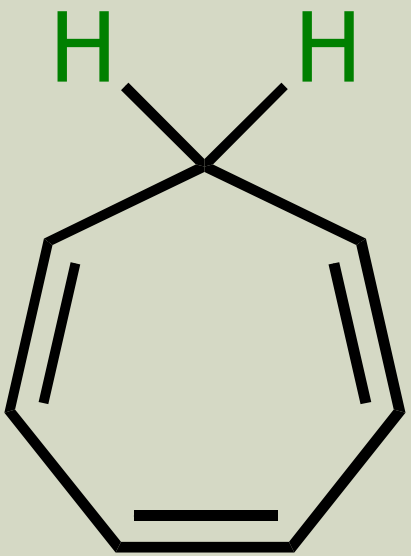
Arrow Pushing &

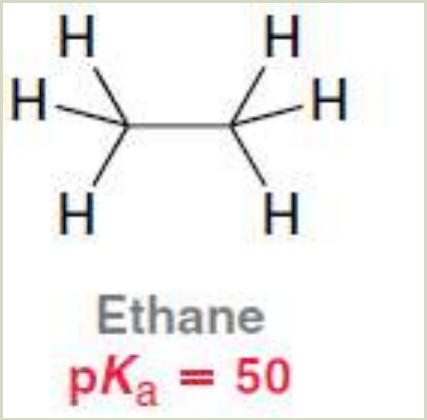
Moving Electrons

Predict the trend in acidity for the following compounds.

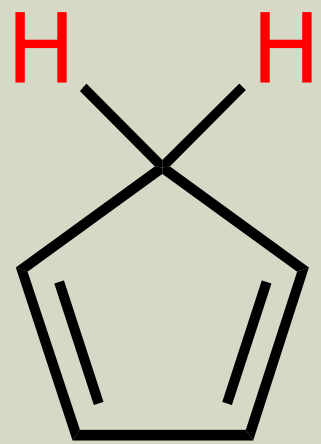
Rank by increasing acidity and explain (Hint-draw conjugate bases).



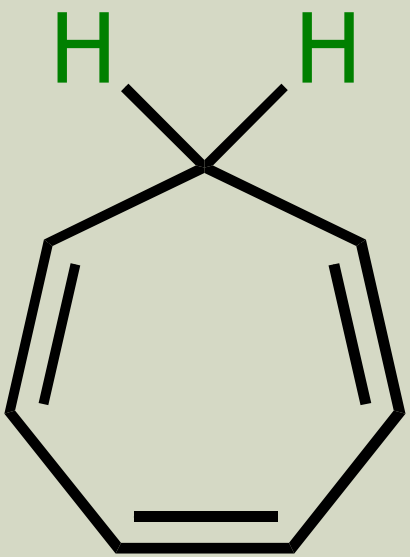




pk_a = 16



pk_a = 36

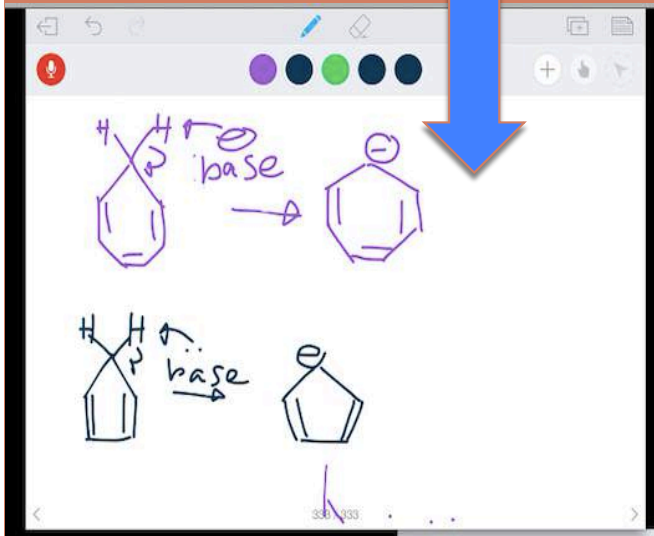


The pK_a value for cyclopentadiene is much lower than typical C-H bonds.

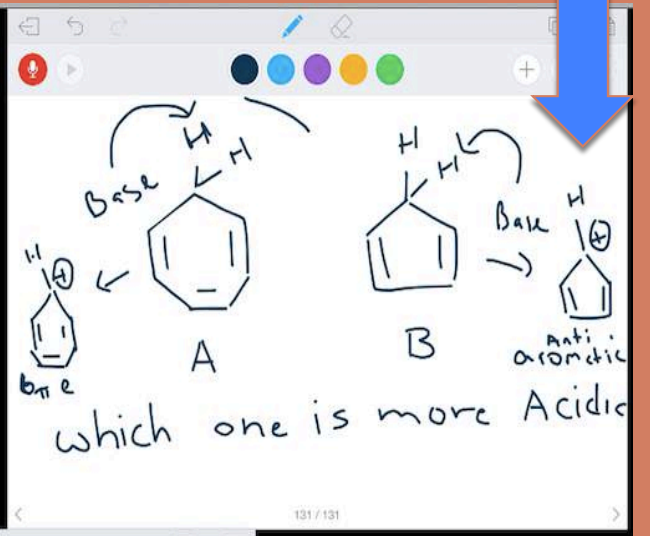
Anion

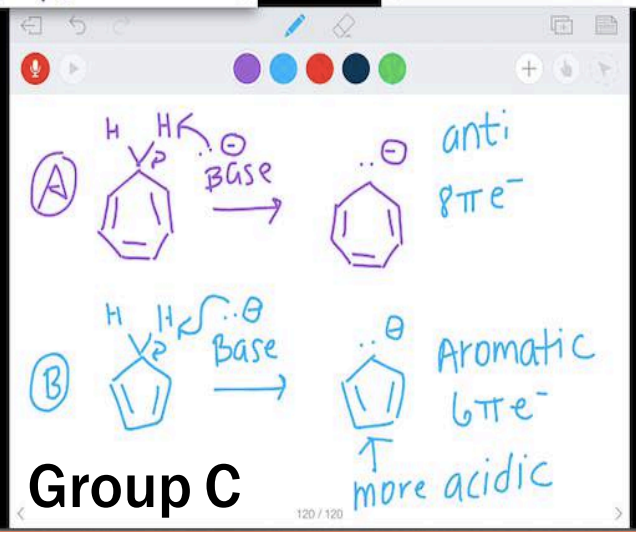
Cation !!!!

Group A



Group B





Group C

Acid-Base Reactions

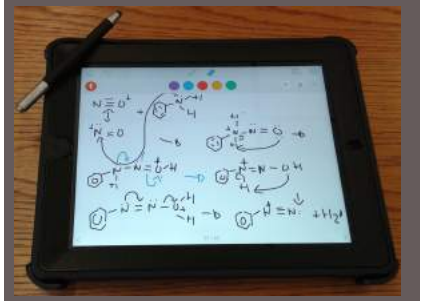
Aromaticity Organic-II

Providing formative Assessment

Helps Reinforce Conceptual Understanding

ADVANTAGES OF iPad USE

A. Ability to identify specific problem areas for students and correct their errors with immediate feedback
B. Students can learn from the misconceptions and mistakes of their peers
C. Students are more engaged, since they are likely to be randomly called on to solve a problem for the entire class
D. Students learn that there are multiple approaches to solving the same problem



CHALLENGES

A. Explaining the importance of formative assessment to students

B. Changing classroom culture

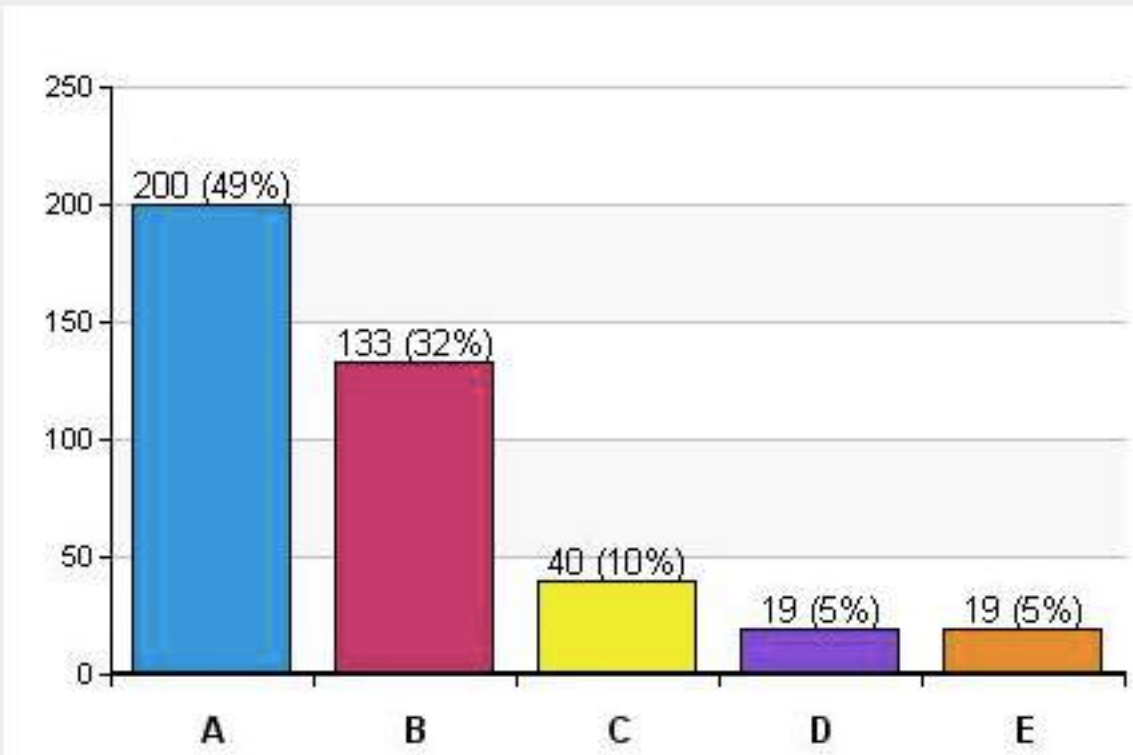
C. Set up – charge iPads and get ready before class

D. Need self-motivated volunteers (peer mentors)

Student Survey: Learning with i-clickers

I have increased my understanding of organic chemistry by participating in the clicker questions during lecture

A. Strongly agree (enjoy active learning)
B. Some what agree
C. Undecided
D. Somewhat disagree
E. Strongly disagree (waste of time)



49 %

Strongly agree

i-clicker

Helps

Learning

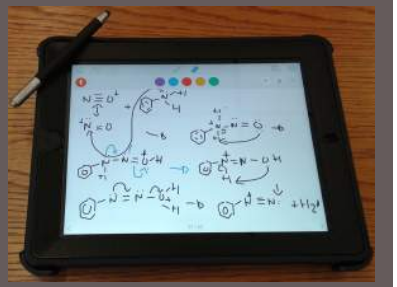
Student Survey: Learning with iPads (Spring 2015)

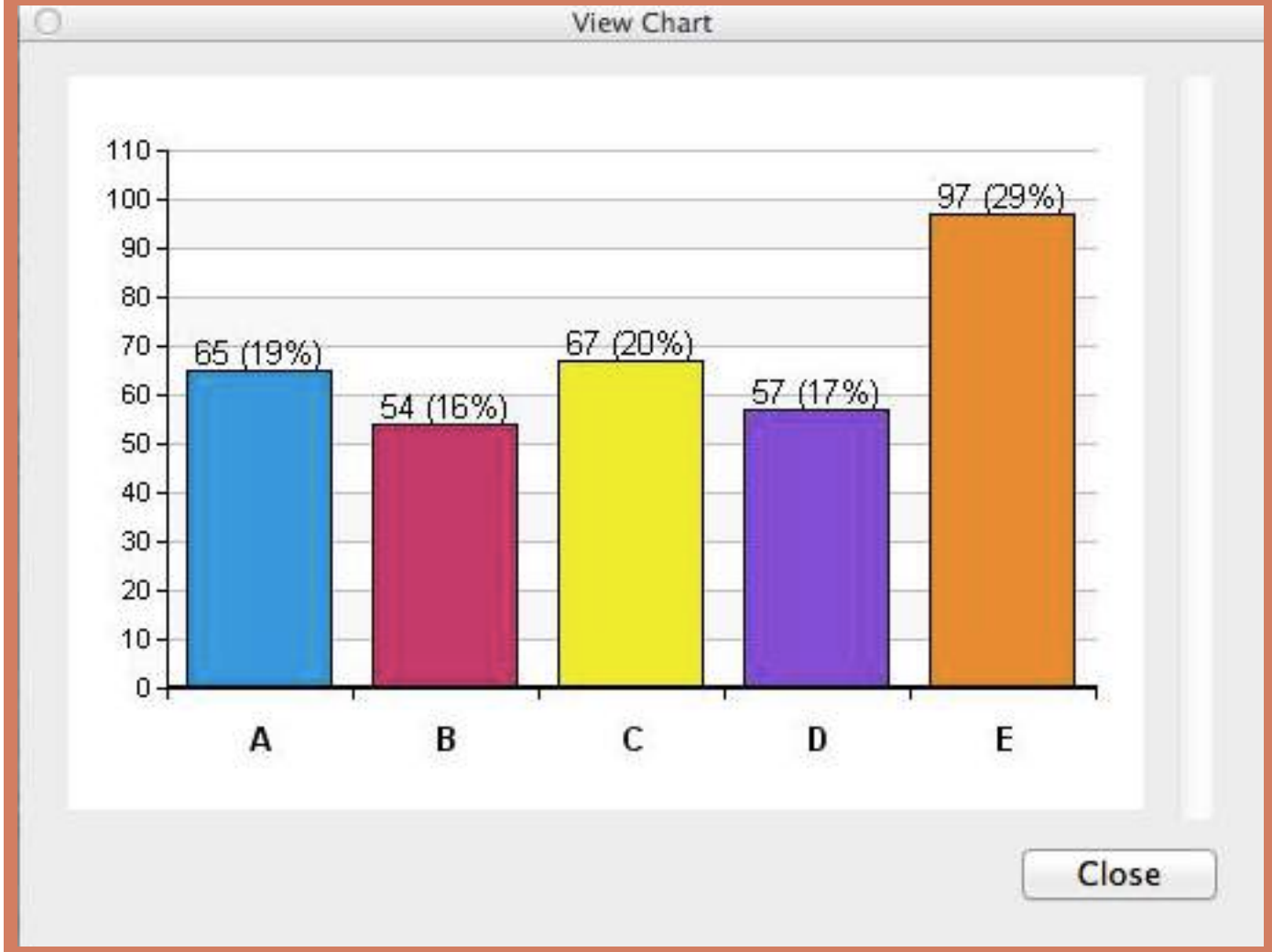
Question 7

Peer Instruction requires students to be significantly more actively involved and in-dependent in learning than does a conventional lecture class. It is common for some or many students to be initially skeptical about this form of instruction. Your instructor used iPad for peer instruction along with i-clicker. Rate your experience of use of iPad as method of peer instruction over the semester.

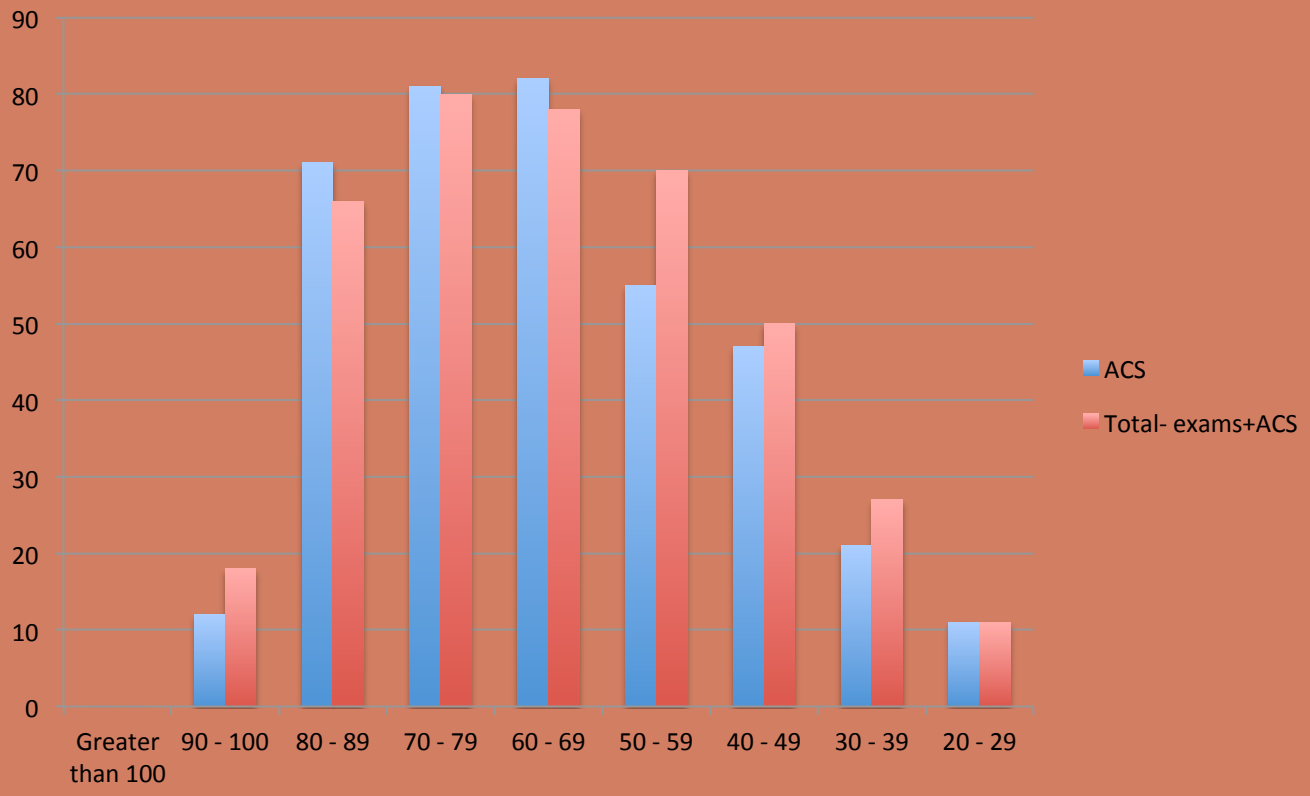
A) 5 – Excellent (experience for active learning)
B) 4 - Very good
C) 3- Good
D) 2- Satisfactory
E) 1- Poor (I did not enjoy participating in active learning. I want my teacher to do all the writing and explaining)

Close




View Chart
110
100
90
80
70
60
50
40
30
20
10
0
65 (19%)
54 (16%)
67 (20%)
57 (17%)
97 (29%)
A
B
C
D
E
Close

ACS and Exam Performance



ACS scores

10% above national average

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&

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Office of Assessment

FUNDING

ACERT Helping faculty innovate in pedagogy, technology, and assessment

FITT 2014: Empowering student learning in *Organic Chemistry* by designing a flipped classroom

PSC-CUNY 2015: Using Electronic Voting Systems (i-clicker) and Multiple Choice tests (Scranton) data to understand how students learn and identify common misconceptions in learning undergraduate Organic Chemistry

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Helping faculty innovate in
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Resources
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TEACHING ASSISTANTS

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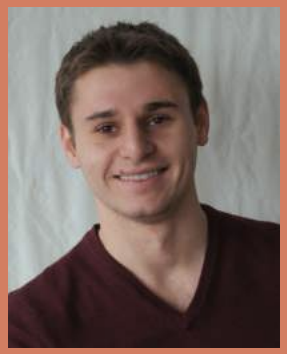

Roman Povolotskiy

Jaclyn Yamada

Samantha Schoer

Dr. James McNamara

"I've learned that people will forget what you said, people will forget what you did, but people will never forget how you made them feel."

- Maya Angelou

PEER MENTORS

Ali Khaleel

Sharon Pang

Henry Yelkin

AND TO ALL MY ORGANIC CHEMISTRY STUDENTS

THANK YOU!

The Three Great Ancient Teachers

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