



Classroom Response Systems

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Agenda

- Introduction / Why use Clickers?
- Areas of Concern
- Tips and Techniques for
 - Designing
 - Learning
 - Presenting
- Summary and Close

University of Jordan

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Objectives

- Describe the pros and cons to clicker and non-clicker based systems
- Explain how to design poll questions
- Compare and contrast student response systems



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Intended Learning Outcomes

Should be able to:

- Defend the benefits of active learning
- Develop a repertoire of learner-centered group activities
- Use clickers effectively for active learning (and formative assessment)
- Defend the value of group discussion
- Find ways to deal with the “coverage” problem

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Have you ever used a student response system (Clickers), as an instructor or a student?

- Left) Yes
Right) No
Both) A little

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Agenda

teaching, how successful did you and your students find them in facilitating learning?

- A) Highly successful.
- B) Somewhat successful.
- C) Not much of an effect.
- D) They had a negative impact on the course.
- E) They were a waste of time and effort.

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When I lecture to a large group of students I feel they always pay attention?

- A. Strongly Agree
- B. Agree
- C. Neutral
- D. Disagree
- E. Strongly Disagree

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What are practical "constructivist" alternatives to lecturing in large classes?

Almost any activity, **preferably cooperative and with timely feedback**, that requires students to recall, think about, apply, and verbalize concepts in the course, rather than simply record facts for later memorization.

I.e. active learning activities rather than or in addition to lecturing.

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- Research based, student-centred
- For active learning
- Developed in 1990's by Eric Mazur, Harvard University
- Flipped learning approach
 - Teaching by questioning rather than teaching by transfer of information
- Students are asked to prepare beforehand either individually or as a group
 - Read lecture notes
 - Or watch a presentation

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What are clickers?



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Teaching Experiments (Student Response in Lectures)

1. Student response in lectures

- Colored cards
- Electronic "Clickers"



Students 'vote' for multiple choice answers during lecture



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Student Response in Lectures

2. Classroom activities

- Worksheets
- e-Tutorials
- e-Labs

3. Learning Groups

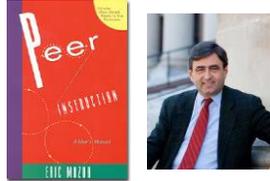
- 5-10 students with UG coach
- Group meetings instead of lectures

- Allows for interactive participation even in the largest classrooms
- Technology records student responses, allowing performance to be graded

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Peer Instruction

An interactive method developed by Harvard physicist **E. Mazur** for large group lectures



• Eric Mazur. PEER INSTRUCTION: A User's Manual. Prentice Hall Series in Educational Innovation, NJ 07458 ©1997

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Peer Instruction

Format of the Peer Instruction process

Ask a question

Allow time to **think** about the question (individually)

Commit to an answer

POLL

Eric Mazur. PEER INSTRUCTION: A User's Manual. Prentice Hall Series in Educational Innovation, NJ 07458 ©1997

Clickers:

"the greatest new teaching tool since chalk"

Clicker Based System



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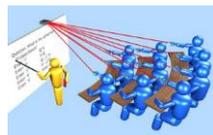
Student Response in Lectures

Electronic Clickers

- 'Hyper-interactive Teaching Technology' [www.h-itt.com]
- Each student purchases a 'clicker stick' and registers it online, linking the transmitters' unique ID with their own
- \$30 each, bought back at \$15.
- Classroom outfitted with receivers, a computer and projector.
- \$10k for 250-student lecture hall

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- Students respond to a multiple-choice question with their 'clickers'



- After the instructor closes the answering period, a histogram of votes appears on the screen (usually a different screen from the question screen)



- The instructor tailors the ensuing discussion around responses, focusing on incorrect responses as appropriate.

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Students' appreciation of "chalk and talk"



Richard Thompson, Imperial College London

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The effect of using coloured chalk



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E-learning in JU

- With 255 students in a 240-seat lecture theatre we had to adopt new technology!
 - Video-conferencing to an overflow room
 - Students see a high-resolution image of the lecturer and blackboard
 - Electronic media on a separate screen
 - Number using the overflow steady at ~15
- **Blackboard** is used for all lecture notes, PowerPoint presentations, problem sheets...
 - Though students preferred our previous intranet
 - Slow to adopt quizzes & discussion boards
- **Metric** for summer revision
- **PowerPoint** has been tried by many lecturers with a mixed reception...

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Personal Response Systems (PRS or Clickers)

"Clickers" are boxes like TV remote controls that allow students to select one answer from a selection and transmit that to a central PC: the results displayed as a histogram.



Wireless keypad: 'Clickers'

We bought clickers which use infra-red to communicate with two receivers installed in our main lecture theatre. The receivers link via USB to a PC.

We bought 250 clickers and 4 receivers for around £5500 (part funded by College).

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Wireless keypad: 'Clickers'

Harvard students answer by entering their choice on a 1-way IR remote (PRS)

They can even rate their level of confidence (Hi,Med,Lo)

Ok, its Harvard! (i.e. \$\$!)

Well, costs about 25\$/stud

JAC Sc Prog has 190 Units

Publishers now packaging clickers with books

Quite feasible/affordable

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Why use clickers?

- Helps students to engage with the lecture
- Forces them to think about a question
 - *and decide on an answer independently*
- Well-designed questions can help reinforce key concepts
- And it's fun
- How does it work?
 - Question is included in a PowerPoint slide
 - Students are given (say) 5 choices
 - Select one and press the appropriate button
 - Afterwards bar chart of responses is given

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Using the clickers

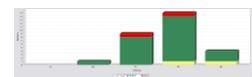
Allows instructor to have high quality real-time feedback

In Class: Interaction, Feedback

Actively engages Students in course content (without intimidating them)

Also, they get to feel what its like to be on "who wants to be a millionaire"

Some have reported increases in attendance when using the clickers!



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Instructor morale improved!

- Higher attendance
- Satisfaction of student interaction
- Real-time feedback keeps lectures on track

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Clicker Based System

- Something hand held that is a stand alone device
 - Can download smart phone apps
- All research is based on these systems

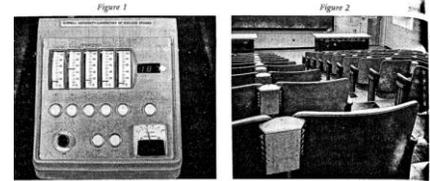


Figure 1
Figure 2
... is technically more complex and can bury the
The fact that a student cannot change his mind is
Littauer, R. (1972). Instructional Implications of a Low Cost Electronic Student Response System. Educational Technology, Teacher and Technology Supplement, 12(10), 69 - 72.

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Clicker Based Systems Pro

- Increases Class Participation
- Instant feedback on student retention
- Classes with clickers get better grades
- Better formative assessments
- Multiple Choice or Short Answer
 - Based on system
- LMS integration

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Clicker Based Systems Pro

- When students are provided test questions during lectures they remember them better
- Students feel heard
- 4 months after the end of class students with clickers remembered more

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What the students say

Clickers made me feel involved in the course
 Using clickers helped me pay attention in class



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Real-Time Feedback

Students raise a card A,B,C...

The instructor gets instant feedback

Does majority get it?

- Yes, proceed to next concept

Majority doesn't get it

- Identify most prevalent misconceptions
- Address specific misconceptions



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Properly used, clickers can:

- Engage students
- Promote active learning
- Allow for anonymous responses (shy student, cultural diversity, different ages)
- Provide feedback visually
 - Correct answer
 - Level of overall understanding in class
- Surprise instructor and students
- Immediately deal with misconceptions
- Assess level of engagement
 - Response appropriateness
 - Pre-reading complete?
 - Deeper level of thinking engaged?
- Take attendance (not necessary)
- Used easily by faculty
 - Limited IT savvy required

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Why should I use clickers?

- A. To allow students from different ethnic groups to participate
- B. To create an active learning environment
- C. To help the student understand what they do/do not understand
- D. All the above

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Why use clickers?

- ❖ Increase attention and engage students "fun"
- ❖ Changes the monotony of passively taking notes
- ❖ Increases interaction with the instructor and other students

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Additional Uses:

1. Attendance
2. Reading comprehension, to encourage reading before lecture
3. Predicting what will happen in a demonstration
4. Grading Worksheets completed during class (in groups)
5. Demographics - who attends, who is getting what type of answers right/wrong, who dis/likes what.....

1: Student Response in Lectures

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Pros:

- Student engagement with material
- Group learning
- Instructor gets chance to talk with smaller groups

Cons:

- Less material "covered"
- Limited to smaller classes?
- Technology intensive
- Limited to interactives developed to date

2: Classroom Activities

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3: Learning Groups

Pros:

- Student engagement with material
- Group learning
- UG coaches popular
- Valuable experience for UG coaches
- Project-based assessment

Cons:

- Less material "covered"
- Extensive organization of learning groups
- Discussion sessions depend on style of instructor
- Maintenance/development of software takes time/funds

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Lessons Learned - 1

Hard - for both students and teachers - to change culture of large lecture classes

HUGE improvements in morale of both students and faculty

In reality, requires changing classrooms - not just a website



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- ❖ Senior faculty advocate helps
- ❖ Multiple approaches
 - ❖ not top-down, experiments,
 - ❖ sharing results
- ❖ Flexible, modular tools more sustainable than whole course
- ❖ Encouraging different styles of teaching

➤ What We Don't Know:

- Do students learn more? Is this the right question?
- Will the novelty wear off?
- How to fund continued development?
- Whither technology?

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My teaching dilemma

How can I get students to "dig deep" in classes



I need to "lecture less" and encourage students to "learn more"

How do I enable students to:

- Conceptualize (see the big picture instead of small isolated parts)
- Analyze (problem solve), case studies to integrate knowledge (increase critical thinking)
 - Shift from "giving" the information to "getting it"
- Collaborate (peer learning, team work)

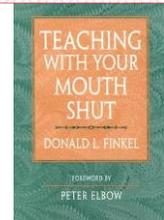
Feedback

- Do students "get it"?
- Do I focus on the critical areas?
- Do I worry more about volume instead of concepts?

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Teaching with your Mouth Shut:

Let the students Do the Talking
Teaching Through Writing
Let the Books do the Talking



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Is Peer Instruction will be effective in JU??

Future measure and study

A study on Peer Instruction needed

Addressed the following 3 empirical questions:

1. Can Peer Instruction be implemented in Cegep?
 1. To date, studied mostly in American universities...
2. Is Peer Instruction more effective than traditional instruction in Cegep?
 1. Does it increase conceptual learning?
 2. Does it decrease traditional problem solving skills?
3. Do clickers work better than flashcards?

Study looked at 3 groups of 1st semester physics students

Gp1: CLICKER Peer Instruction
Gp2: FLASHCARD Peer Instruction
Gp3: CONTROL group, traditional inst

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THE METHOD

Starts with brief lecture

- 10-15 min = avg attention span

multiple choice conceptual questions are then presented to the class

Questions have scientifically accurate concepts

AND prevalent student misconceptions

Students try to pick out the right answer from a number of detractors

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Important to ask a question that goes beyond memorization

Two critical pointers for clicker questions:

- 1) Don't leave out student discussion !
- 2) Don't forget to discuss what happened !

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Google JiTT



Instructor assigns pre-class work to be submitted online.

Instructor can assess it in advance, gauge the level of understanding, and plan use of class time accordingly.

If you ask students why they read the textbook, they say it's to help them understand the lectures.

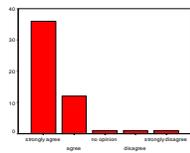
It should be the other way around: students should be coming to class in order to get help understanding the reading!

(E. Mazur)

Instructor assigns pre-class work to be submitted online.

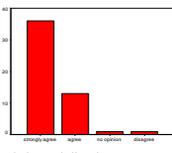
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Lectures were more interesting with clickers



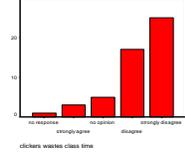
lectures are more interesting

Class is more enjoyable using clickers

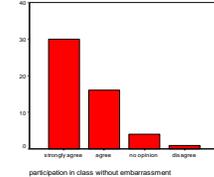


class is a more enjoyable experience

Clickers waste class time



clickers wastes class time



participation in class without embarrassment

Nathaniel Lasry, Physics Dept, John Abbott College, Div of Engineering & Appl. Sc, Harvard, 2007.

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I would like to use clickers in my class

- A. Strongly Agree
- B. Agree
- C. Neutral
- D. Disagree
- E. Strongly Disagree

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Advantages

Engaging the students in active learning

Two way flow of information:

- Teacher to student
- Student to teacher –therefore instant feedback

Encourages creative/critical thinking and risk taking by the students

Encourages self efficacy- builds confidence

Studies have shown triple the learning gain
Actively involves the students in the learning process

It's easier to sit passively!

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Some side benefits of clicker use

Students come to class

Impromptu quizzes

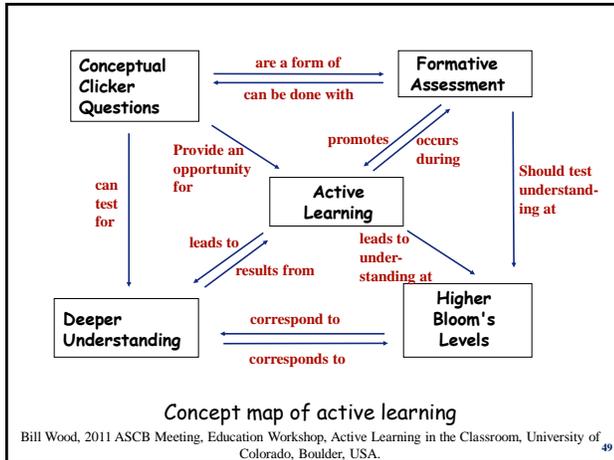
Attendance records

Obtaining demographic information

Monitoring performance of individual students

Getting honest answers to touchy questions

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More on Peer Instruction

Since the instructor then has *instant* feedback on how the class is doing

S/he can choose to revisit the concept if the % of right answers is too Low (<35%)

If the % is not too low, then students are asked to turn to their neighbor and convince them of their answer → students revote.

Levels of correct answers

increase significantly

Best way to learn is often to

teach others/ verbalize idea...

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JU and innovation?

- Physicists have a reputation for resisting innovation
- "Chalk and Talk" is well suited to mathematical material

Need to see a mathematical proof evolving step by step

This is clumsy with PowerPoint or OHPs

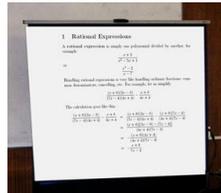
Blackboards allow students to see *in real time*

where each piece of an equation comes from

Blackboards give a running history that can be referred back to

Blackboards allow a lecture to become theatre

- The students themselves prefer "Chalk and Talk"



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Example of a clicker question

What gives the colour to butterfly wings?

- A Coloured dye
- B Light absorption
- C Interference
- D Diffraction
- E Refraction
- F Fluorescence

The idea is not to test recall but to ask questions that require students to think about the issues involved to find the solution

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SOME QUESTIONNAIRE RESULTS (including SOLE)

More clickers please, for every course!

Like the new approach. Lectures are more interesting and engaging.

The lecture time is far more efficiently spent, with the run through of concepts visually much more useful that droning out a set of lecture notes.

New approach to teaching, which is much more useful, as it gets us to think about the material introduced to us

Clicker questions are fun and promote discussion in class.

Great lecturer, great course, shit clickers.

Less time devoted to clickers, as they waste valuable lecture time

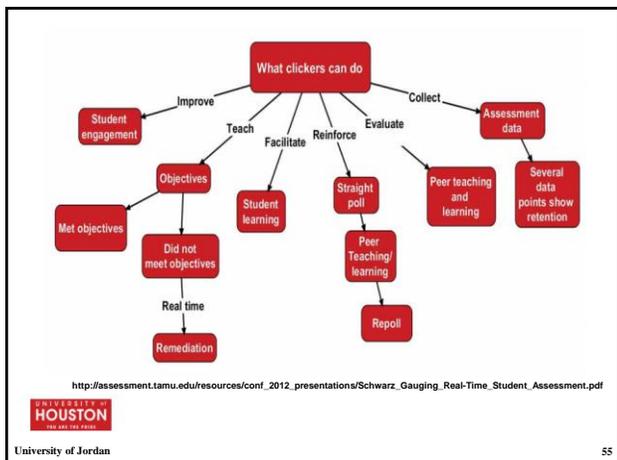
The clickers are a waste of time, money and no-one takes them seriously. I like the new lecture format but the polls are just silly.

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Lessons learnt . . .

- Most students responded well to a more interactive lecture style
- There was a good "buzz" in the lecture theatre
- Exam performance was at least as good as previously
- The clickers generally worked well
 - Instant feedback for students and lecturer
- HOWEVER:
 - Amount of time needed for preparation is very large
 - There are issues with the large numbers of clickers
 - Heavily reliant on the technology: need good technical support
- In conclusion:
 - *Even in physics*, innovation can be adopted successfully
 - E-learning gives us tools that can enhance teaching and learning
 - Need to evaluate carefully where innovations are appropriate

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Uses of Clickers/Polling

1. to increase or manage interaction, through questions that:

- start or focus discussions
- require interaction with peers
- collect votes after a debate

2. to assess student preparation and ensure accountability, through:

- questions about reading or homework
- Prelab questions

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Uses of Clickers/Polling

3. to find out more about students, by:

- surveying students' thoughts about the pace, effectiveness, style, or topic of lecture
- polling student opinions or attitudes
- probing students' preexisting level of understanding
- asking how students feel about clickers and/or active learning

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Uses of Clickers/Polling

4. for formative (i.e., diagnostic) assessment, through questions that:

- assess students' understanding of material in lecture
- reveal student misunderstandings of lecture
- determine future direction of lecture, including the level of detail needed
- test students' understanding of previous lecture notes
- assess students' ability to apply lecture material to a new situation
- determine whether students are ready to continue after working a problem

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Uses of Clickers/Polling

5. for quizzes or tests although reports of using clickers for summative high-stakes testing are relatively rare. Quiz questions typically check whether students are:

- paying attention
- taking good notes
- preparing for class or labs
- keeping up with homework
- actively thinking
- able to recall material from previous lectures

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Uses of Clickers/Polling

6. to do practice problems, especially in math, chemistry, engineering, or physics courses

7. to guide thinking, review, or teach, including questions used to:

- review at the end of lecture
- give prelab tutorials
- review for a test
- lead students through a multistep process by asking which

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Uses of Clickers/Polling

8. to conduct experiments on or illustrate human responses
9. to make lecture fun



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Non- Clickers

- Web based
- Web enabled device



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Student Response Systems Non-clickers

• Non- Room Systems

- Poll Everywhere

• Room systems

- Naiku
- Infuselearning
- Socrative
- Kahoot!

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Cons

- No research
- No LMS integration
- To many people on wifi
- May lead to more distracted students
 - Reduced learning

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Benefits of clickers

For me, the instructor:

- I know you're there (later)
- I can find out how you answered (later)
- I know instantly what fraction of you didn't understand !

For you, the student:

- Responses are anonymous
- Instant comparison to your peers
- You're active and engaged !

(Active learning and formative assessment.)

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Poll Everywhere - Pro

- Free with limitations
- Easy interface
- Multiple ways to answer
 - Text
 - Twitter
 - Website



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Poll Everywhere - Con

- Can not specify student
 - Pay version - \$65 a month
- Need to download special software to incorporate into slide show
- Can only hold 40 participants
- Reports are pay also
- Need to have the software loaded on a computer

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(Adapted from Janet Batzli and Diane Ebert-May)



Three identical plates of radish seeds are incubated under three different conditions, with results as shown. How will the dry weights of the three plates compare at the end of the experiment?

- A) $1 < 2 < 3$
- B) $1 < 3 < 2$
- C) $1 = 3 < 2$
- D) $3 < 1 < 2$
- E) $1 = 2 = 3$

Bloom's level?

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Room Based Technology

- Naiku
- Infuselearning
- Socrative
- *Kahoot*

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All Room Based offer

- Prewritten Questions
 - Except for Naiku
- True / False
- Short Answer
- Multiple Choice
- Statics
 - But not real time

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Naiku

- Teacher a.naiku.net
- naiku.net
- Faculty has to show results to student to see results
- Can't make associations in real time
- Can not preload questions
- ABCD
- Exit Tag

The logo for Naiku, featuring the word 'Naiku' in a stylized font with a green figure of a person integrated into the letter 'i'.

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Infuselearning

- Teacher.infuselearning.com
- Student.infuselearning.com
- Multiple rooms – open/private
- Draw
- Likert scale
- Sort and order

The logo for InfuseLearning, featuring the word 'InfuseLearning' in a stylized font with a green figure of a person integrated into the letter 'i'.

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learning catalytics

My Courses > Introductory Chemistry 1, Chem 1010 > Template 4

Current session: 83702352 | 0 students

What is the best percent of O in Pentoxide , $\text{C}_2\text{H}_2\text{N}_2\text{O}_5$, a molecule that is associated with the "hot gas" properties of smog?

Answers:

$$\begin{array}{c} \text{:}\ddot{\text{O}}\text{:} \\ \parallel \\ \text{C} \\ \parallel \\ \text{:}\ddot{\text{O}}\text{:} \end{array}$$

Notes

If this is a little too much at once, consider going from the skeletal structure, and having them put it in the sketcher. The question could also be broken down into parts: what is the central atom? How many valence electrons? Skeletal structure? Lewis structure?

Template 4 (83702352) 0:46

Draw the Lewis dot structure for a nitrogen atom.

learning catalytics

My Courses > Introductory Chemistry 1, Chem 1010 > Chapter 3 > Session 3030509

Round 1

What is the best percent of O in Pentoxide , $\text{C}_2\text{H}_2\text{N}_2\text{O}_5$, a molecule that is associated with the "hot gas" properties of smog?

Answers:

- A. 10.25%
- B. 17.75%
- C. 8.88%
- D. 8.9%
- E. 8.88%
- F. 17.8%
- G. 31.04%
- H. 31.0%
- I. 18.1%

| Student | Points | Answer |
|---------------------|-------------|-----------|
| Abraham, Monrovia | 0.00 points | Incorrect |
| Adams, Maggie | 2.00 points | Correct |
| Alford, Devante | 2.00 points | Correct |
| Ali, Stephanie | 0.00 points | Incorrect |
| Davis, James | 0.00 points | Incorrect |
| DeWayne, Christine | 2.00 points | Correct |
| Diwan, Sam | 0.00 points | Incorrect |
| Edwards, Miranda | 2.00 points | Correct |
| Doyne, Robert | 2.00 points | Correct |
| Espinosa, Mateo | 0.00 points | Incorrect |
| Elsworth, Catherine | 2.00 points | Correct |
| Fisher, Mikaela | 0.00 points | Incorrect |
| Ford, Heather | 0.00 points | Incorrect |
| Gook, Brianna | 2.00 points | Correct |
| Green, Samantha | 0.00 points | Incorrect |
| Hudson, Melissa | 0.00 points | Incorrect |

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- Communication: Speech Comm
- Computer Science
- Decision Science
- Economics
- Education
- Engineering: Chemical
- Engineering: Civil and Environmental
- Engineering: Electrical
- Engineering: Industrial
- Engineering: Intro Level
- Engineering: Mechanical
- English: Composition
- Finance
- Further Education
- Geography
- Health
- History
- Hospitality, Travel, Tourism & Leisure
- Information Systems
- Journalism
- Law
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- Literature
- Marketing
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What is the Top Hat Marketplace?

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Thank you!

Any Questions?

Before you Speak

THINK

T ... Is it True?

H ... Is it Helpful?

I ... Is it Inspiring?

N ... Is it Necessary/Noble?

K ... Is it Kind?