Applying clickers as an interactive teaching and assessment tool in the chemistry class

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Brief survey

What’s of your major?

- A. Science or engineering area related to chemistry
- B. Other science area except chemistry
- C. Engineering without relation with chemistry
- D. Social science area( Economics, literature, etc)
- E. Professional schools( law, medical, business, etc)
Introduction

Have ever used iclickers before?

- A. I’ve never heard of them
- B. I’ve heard of them but I’ve never used them
- C. I’ve used them as a teacher
- D. I’ve used them as a student
Teacher’s comment about clickers
Student’s comments
What do students think?

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

Organic Chemistry Spring 2006
Clickers

SDSU Faculty and Student Clicker Participation

Clicker Course Student Enrollment Capacity

Course Capacity  Faculty

14000
12000
10000
8000
6000
4000
2000
0

Fall 2006
Spring 2007
Fall 2007
Spring 2008
Fall 2008

Boehmler, Deb; Smith, Ann C.; Teaching with Technology, 2006
Different types of clicker questions

Faculty self-reported average frequency of use of different types of clicker questions.
Purposes of using Clickers

1. Engagement
2. Informal assessment
3. Peer Instruction
Engagement

Goal: To get students’ attention and interest.
Example Question 1
Which phenomena is regarded as a chemical change?
A. Tearing paper
B. Evaporating Alcohol
C. Burning a Candle
D. Melting Snow
E. Cutting Glass
Engagement

Example Question 2

Which chemical item is NOT included during the metabolism of plants?

A. Carbon dioxide (CO$_2$)
B. Oxygen (O$_2$)
C. Water (H$_2$O)
D. Silicon dioxide (SiO$_2$)
Engagement

- Discussion
  What are the features of Engagement Questions?
Engagement

Characteristics of an effective engagement question:

- Brief and simple
- Interesting
- Related to prior/basic knowledge
Design a simple engagement question about effective teaching methods

Hint: we have already used several different effective teaching methods in our workshop.
Informal Assessment

- Goal: Instructor gets an idea of who does and doesn’t understand. Based on the feedback, the instructors are able to lead an audience-paced lecture.
Informal Assessment

Example Questions 1

what is the product of the reaction below?

\[
\begin{align*}
\text{CH}_3\text{COH} + \text{CH}_3\text{CH}_2\text{CH}_2\text{OH} & \xrightarrow{\text{H}_2\text{SO}_4, \text{heat}} \\
\text{1) CH}_3\text{CH}_2\text{COOCCH}_3 & \quad \text{3) CH}_3\text{CH}_2\text{CH}_2\text{CCH}_3 \\
\text{2) CH}_3\text{COCH}_2\text{CH}_2\text{CH}_3 & \quad \text{4) CH}_3\text{CH}_2\text{COCH}_2\text{CH}_3
\end{align*}
\]
Informal Assessment

Example Questions 2
Which of the following contains the largest number of molecules?
A: 1g of NH₃
B: 1g of HF
C: 1g of H₂O
D: 1g of CH₄
E: All of them are Same
Informal Assessment

- Strategies if students make mistakes
- 1. (10% wrong) Go over correct answer, emphasize
- 2. (>50% wrong) Clarify the problem through scaffolding question process.
- 3. (25~30% wrong) Have students discuss with peers
Peer Instruction

- What is Peer Instruction?
  Step 1: “Think” phase
  Step 2: “Pair/Share” phase
Peer Instruction

- Goal: Help students learn more actively and form better solutions during the discussion
Peer Instruction

Example Question:

- Consider the Br$_2$ molecule. If there are two common isotopes, 79-Br and 81-Br, how many physically distinguishable combinations of Br atoms are there in Br$_2$?

A. 1  
B. 2  
C. 3  
D. 4  
E. None of all
Peer Instruction

Example Question:

How many degrees of unsaturation are there in benzene?

A. 2
B. 3
C. 4
D. more than 4
Peer Instruction

Discussion

How can peer instruction positively impact learning?
Peer Instruction

Benefits of Peer Instruction

- Students will be more likely to discuss freely with peers than professors
- Students will reach higher levels of understanding (1. Just listen 2. Listen and see 3. Do/discuss 4. Teach others)
Conclusion

Applying Clickers
- 1. Better class interaction and engagement
- 2. Quick feedback
- 3. Improve teaching & learning effectiveness
Resources

- [1] Thomas A. Angelo K. Patricia Cross, Classroom assessment techniques, 2nd edition,
- [3] David E. Smith, Teaching academy innovation award application,
Questions