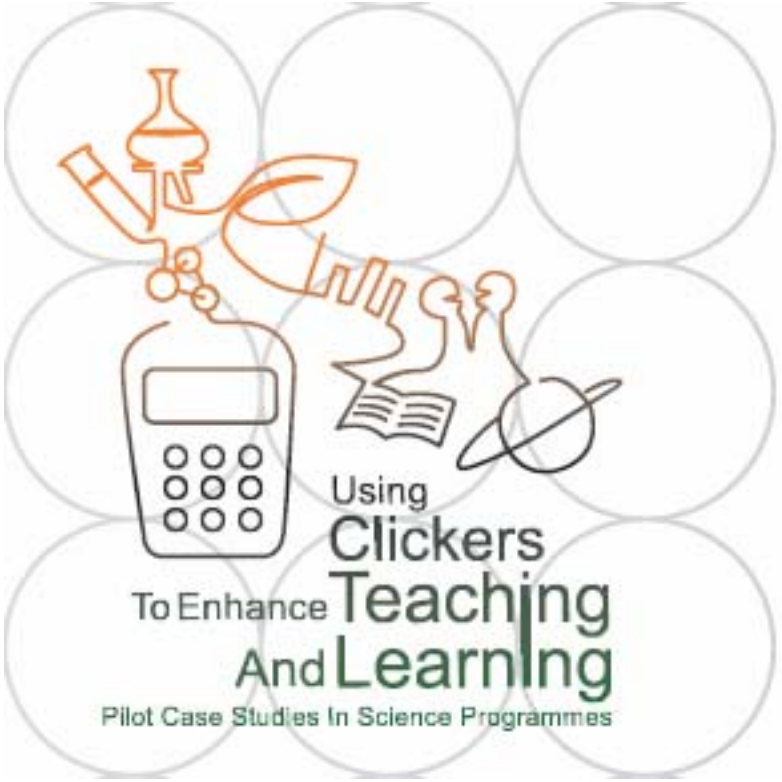
Using Clickers to Enhance Teaching and Learning: Pilot Case Studies in Science Programmes



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Examples:

Studying Toxicology through Questions

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Using Clickers in Learning Cell Biology (BIO2120)

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What is a “Clicker”?

- A student response system
- Teachers prepare clicker questions (in ppt)
- Students respond to (multiple choice) questions through the clickers
- Students responses are delivered to a receiver that is connected to the computer
- Summary statistics of student responses displayed

The System

Q1: Which of the following is the necessary assumption for the sign test?

A	Data follow a binomial distribution
B	Data come from a continuous distribution
C	Data come form a symmetrical distribution
D	Data are discrete

3

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Why use “Clickers”?

- Difficult to engage students in teaching science
- Students are passive learners
- Classes are large
- Increasing number of successful examples on using clickers to “*make classes more intellectually engaging and educationally effective*” (Carl Wieman, 2008)
- A faculty-level Teaching Development Grant (TDG)project to conduct pilot case studies

What we have done?

- Project launched in October 2008
- Project website constructed to share and disseminate information http://www.cuhk.edu.hk/sci/clicker
- More than 15 science courses have used the system
- Workshop held to share experience and exchange views
- Feedback from teachers and students collected to extract general principles and good practices

The Case Studies:

- CHM2320, BCH2030, BCH4130, BIO2120, BCH4660, ENS3320, ENS3920, MAT4210, PHY2003, PHY3811, STA3005, STA4005, STA4008, STA5102, UGB241M …
- Different disciplines: all science departments
- Different levels
- Different learning activities
- Class size: From 20 to 260
- Examples of the uses of clickers
  - Grab attention
  - Summary of lectures and course revision
  - Assessment
  - Pre-lab quiz (students prepared?)

Comments from students: Benefits

- It makes the lesson more interesting
- It attracts the attention of students
- It gives immediate progress check
- It is environmentally friendly (save paper)
- It enhances interaction
- It motivates discussion amongst classmates
- It shows the understanding of the topic amongst students

Q10: Do you agree that today's activity of using clickers can better engage students in class?

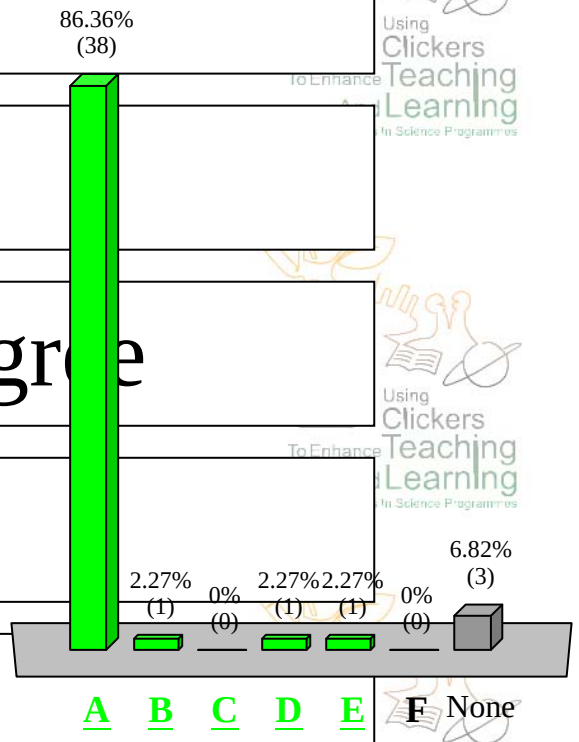
A Strongly agree

B Agree

C Neither agree nor disagree

D Disagree

E Strongly disagree



Comments from students: Ways to Improve

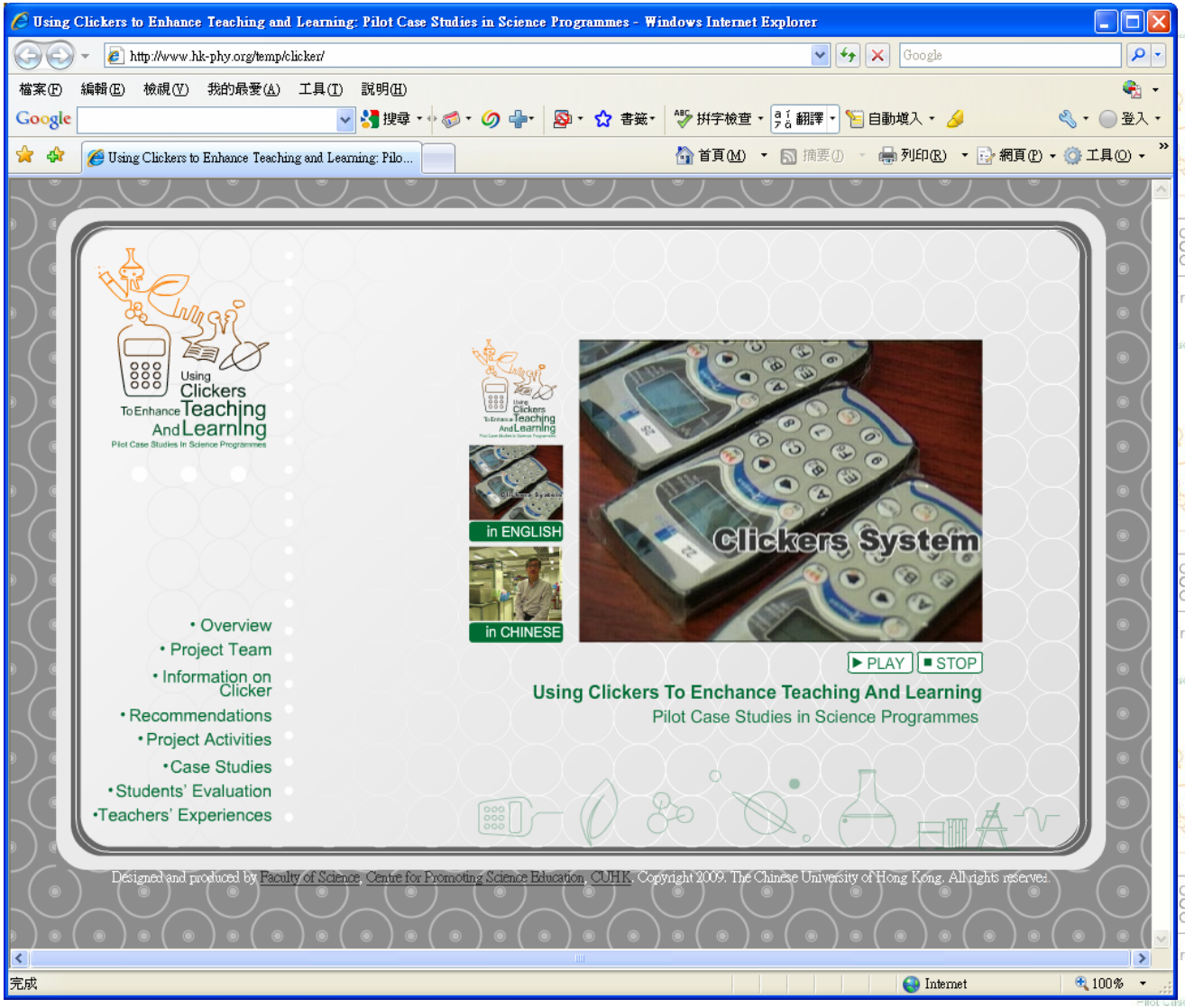
- Use them more often
- Use the system to support other types of questions than multiple choice questions
- Have the clickers embedded in the desks

Teachers' Experience – Clickers' Top 10

1. Clickers enhance interactions
2. Questions & answer sessions become competitive
3. Students become more attentive in class
4. Teachers can better understand students' learning
5. Stimulate students' logical and critical thinking process
6. Facilitate revision and examination preparation
7. Easy, instant and convenient for assessing students
8. Facilitate teachers to tailor their instructions to meet students' needs
9. Can be used in a wide range of settings
10. Good planning and practice make perfect

Project Website

http://www.cuhk.edu.hk/sci/clicker



Specific Examples

Study Toxicology through Questions

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1. Engaging students in classroom to learn and understand key concepts (Cain and Robinson, 2008).

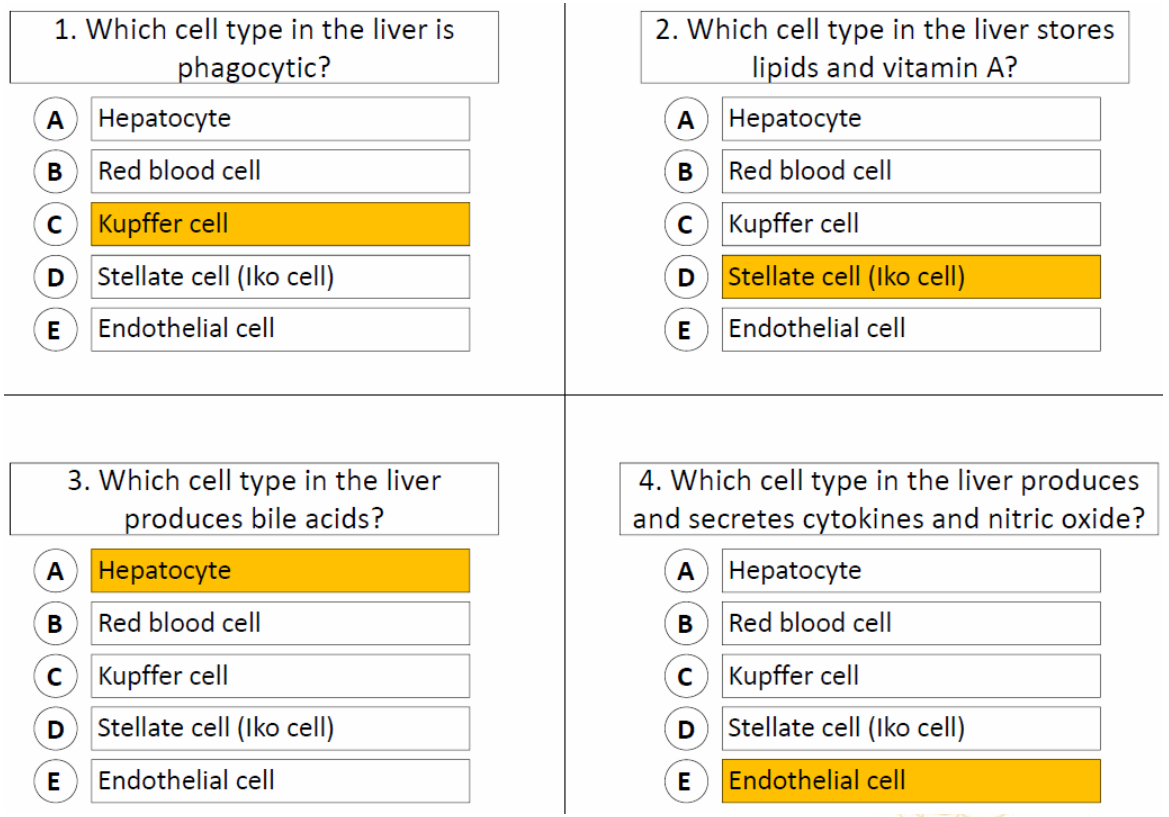
2. Keep students focused, give students a break to understand the key concepts taught, and think of some creative idea of answering questions posted.

3. Teachers in the class can also know the immediate feedback from the students.

Classroom Uses of Clicker (1)

E.g. after a lecture of 35 min. on liver toxicity with liver structures explained, the following questions were posted for students to answer.

~ 80-90% students got the correct answers and the students commented that the clicker system urged them focus in class.



Classroom Uses of Clicker (2)

Questions for reasoning and clarification of key concepts are also useful

1. Dioxins are environmental estrogens BECAUSE they pass through the cell membrane to act on aryl hydrocarbon receptor.

- A: True Assertion with True Reason as correct explanation
- B: True Assertion with true reason but incorrect explanation
- C: True assertion but false explanation
- D: False assertion with true reason
- E: Both assertion and explanation are FALSE

2. Milk contains higher levels of dioxins and PCBs than fruits BECAUSE of its higher lipid or fat contents.

- A: True Assertion with True Reason as correct explanation
- B: True Assertion with true reason but incorrect explanation
- C: True assertion but false explanation
- D: False assertion with true reason
- E: Both assertion and explanation are FALSE

3. Dioxins and furans can induce CYP1A BECAUSE they pass through the cell membrane to act on aryl hydrocarbon receptor.

- A: True Assertion with True Reason as correct explanation
- B: True Assertion with true reason but incorrect explanation
- C: True assertion but false explanation
- D: False assertion with true reason
- E: Both assertion and explanation are FALSE

People from different countries have different food compositions

6. Different countries have different allowable intakes of dioxins/PCBs BECAUSE people in different countries have different levels of contaminations of dioxins and PCBs.

- A: True Assertion with True Reason as correct explanation
- B: True Assertion with true reason but incorrect explanation
- C: True assertion but false explanation
- D: False assertion with true reason
- E: Both assertion and explanation are FALSE

Clicker questions increase or manage interaction for formative assessments, quizzes or tests.

Questions could be set to guide thinking, review and to make lecture fun (Caldwell, 2007).

Similar questions could also be used for case-study and on-line quiz.

Pre-Lab Quiz

Use of Clicker for Pre-Lab Quiz

After the pre-lab talk, pre-lab quiz with 5 multiple questions were posted by using the clicker system one by one.

Students were required to answer them immediately and the scores were calculated instantly (all within 10 min.).

Question 2

What are the two main steps in the preparation of liver microsomes and what is the correct order ?

	First main step	Second main step
A	Homogenization	Differential centrifugation
B	Differential centrifugation	Homogenization
C	Differential centrifugation	Digestion
D	Digestion	Differential centrifugation

Question 3

Which of the following statement concerning CYP1A1 is **TRUE**?

A. It is NOT inducible in liver and other tissues
B. It can be induced by polycyclic aromatic hydrocarbons (PAHs)
C. Its activity is measured by comet assay
D. It is a common biochemical marker for assessment of environmental estrogen exposure

Question 4

Which of the following compound is not studied in this experiment?

A. 3-methylcholanthrene (3-MC)
B. β-naphthoflavone (β-NF)
C. Benzo[a]pyrene (BP)
D. Dichloro-Diphenyl-Trichloroethane (DDT)

Question 5

Upon binding of the Coomassie Brillant Blue G-250 dye to proteins in an acidic solution, what is the colour change and what is wavelength of the absorbance measurement?

A. Red form to blue form, 585 nm
B. Red form to blue form, 595 nm
C. Blue form to red form, 495 nm
D. Blue form to red form, 485 nm

On-Line Quiz with Clicker MCQs

- The quiz consists of 40 MCQs in 4 sections with 10 MCQs each but different from what they saw in lecture.
- Each attempt included 20 MCQs from 4 sections with 5 MCQs randomly selected.
- Students were allowed to have two attempts with the highest score counted.

8 **ON-LINE QUIZ (10% of total scores)**
Available time: April 18 to May 1 (23:55), 2009.
Duration: 40 min for each set of 20 MCQs.
Attempts: TWICE maximum, count highest scores of two attempts.
ON-LINE QUIZ

9 **ON-LINE QUIZ 2**
Available time: May 4 to May 9 (23:55), 2009.
Duration: 40 min for each set of 20 MCQs.
Attempts: TWICE maximum, count highest scores of two attempts.
IMPORTANT: The quiz is created for the students who are affected by the technical problem or unable to do in the specific time. If you are the affected student, please login using the password assigned for you.
ON-LINE QUIZ 2

Problems Encountered and Recommendations

1. All classrooms should be equipped with clicker and students be given one key pad for all courses
2. A “bank” of 100-120 multiple choice questions is needed if such clicker system or classroom performance system is to be implemented in any lecture course.
3. Attendance could be taken but it is difficult to check student id one by one.
4. Extra helping hands are needed for use of clickers and setting on-line quiz.

Thank you very much.