Using Peer Instruction with Concept Questions and Flashcards

What is Peer Instruction?

Peer Instruction is a teaching method that was originally introduced by Eric Mazur (Harvard University, Department of Physics). Basically Peer Instruction consists of asking challenging multiple-choice questions during the lecture. Thereupon the students have to discuss in peers and decide on the correct answer. At the end a voting is performed and the instructor can provide explanations depending on the voting result.

What are Concept Questions?

Concept Questions are questions that require a student to create an answer rather than simply to recall something or to activate an algorithm. They are higher-order questions, and are typically multiple choice questions designed for in-class use, to assess student understanding of a given topic. Student answers to relevant conceptual questions give "real time" feedback to the students as well as the instructor.

What are Flashcards?

Flash cards with numbers are printed and during the vote each student holds up the presumed correct answer number.

How do I apply Peer Instruction in my lecture?

Preparation:

- prepare 1-4 Concept Questions for a 90' lecture,
- distribute the flashcard sheet.

1st Occurrence:

- introduce the aims of the voting activity (self-assessment, feedback for the lecturer, peer discussion),
- explain the procedure, applicable for each concept question:

  1. lecturer gives short explanation of the question
  2. lecturer invites students for peer discussion
  3. students enter peer discussion (2-5 minutes, with announcement 10 seconds prior to the voting)
  4. lecturer invites for simultaneous voting (show up of the flashcards), best done in conjunction with an acoustic signal (bell, ring, etc.)
  5. lecturer detects the distributions of the answers and ends the voting
  6. lecturer gives feedback on the distribution
  7. lecturer announces and explains the correct answer

- perform the procedure.

What are the benefits of Peer Instruction?

1. Engage students in active learning:
   - Apply ideas/skills/problem solving immediately in class;
   - Predict outcomes;
   - Reason in new contexts;
   - Draw connections between ideas.
2. Promote student-student discussion
   - Create a collaborative spirit for supporting learning;
   - Practice justifying a position/responding to arguments;
   - Practice monitoring their own thinking;
   - Aid their learning of technical terminology by using it in discussion.
3. Provide feedback to the instructor about students understanding.
4. Provide feedback to the students about their own understanding, both through their seeing the histogram of responses and in follow up discussion by instructor.
5. Use as formative assessment to guide teaching (measure what students are thinking and then address it): e.g. probe prior knowledge, probe current thinking, uncover student misconceptions.
6. Listen to students' ideas as they discuss and reason about the material.
7. Give students a voice: e.g., survey what they want to learn about most, when to have homework due, some grading policies, when and where to have homework study sessions, if and how to review for exams,…
8. Facilitate student accountability for attendance and reading textbook to prepare for class (quizzes on reading).
9. Model the process of critical thinking through asking questions and figuring out answers in order to promote students doing this themselves.
10. Ensure instructors have not lost touch with what students are understanding and that pace of class is appropriate.
11. Get students to commit to an answer (they are vested in the outcome).
12. Reaffirm learning (positive feedback, review material, etc.).
13. Survey students' background.
14. Send a message that instructor's priority is student learning.

From: Clicker Resource Guide (CU-Boulder and UBC)

Does Peer Instruction work in my lecture?

So far we have experienced good results with flashcards in all physics lectures with more than 100 students. As an alternative the ETH developed EduApp can be used instead of flashcards. It has a voting feature (clicker) and additional functions.

Voting on concept questions during a physics lecture in HPH G2

Do I have to design my own concept questions?

At the moment large collections of concept questions (aka clicker questions) are available on the internet. UC Boulder provides some valuable collections covering classical, modern and quantum physics (http://www.colorado.edu/physics/EducationIssues/cts/index.htm). At D-PHYS we are actually building a collection of validated and lecture tested questions (in German) for our introductory physics lectures.

Where do I get flashcards?

A two-sided sheet (A4) with flashcards should be attached to this guide. Print it double-sided, distribute it and ask the students to fold it twice so that only one number is visible at the front.

Where do I get support?

Ask one of your colleagues who already are using peer instruction (Rainer Wallny, Günther Dissertori, Leonardo Degiorgi, Christian Degen, Andreas Vaterlaus) or contact Guillaume Schiltz, teaching specialist at D-PHYS (schiltz@phys.ethz.ch).

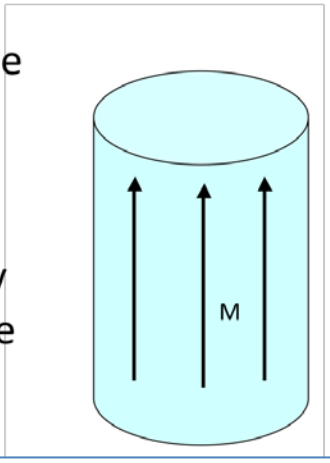
Some helpful hints:

- Allow for an average of 5 minutes to cover each concept question (presentation, peer discussion, voting, and explanation).
- Have always a set of flashcard sheets available that students can pick up during the lecture.
- Make the concept questions plus correct answers online available after they have been discussed in the lecture.

Example of a concept question:

A solid cylinder has uniform magnetization **M** throughout the volume in the z direction as shown.
Where do bound currents show up?

(1) Everywhere: throughout the volume and on all surfaces
(2) Volume only, not surface
(3) Top/bottom surface only
(4) Side (rounded) surface only
(5) All surfaces, but not volume



From: Steven Pollock (CU-Boulder)

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