



Zero cost technology for flipping lectures

Mobile Tablet Project

Aidan Meade, School of Physics, DIT





Objective

Objective

- Flipping the classroom in advanced physics lectures (PHYS 3806 Ionising Radiation and Nuclear Physics);
- Create annotated voiceover pre-lecture recordings with freely downloadable presentation and screen capture software;
- Engender peer instruction time in the classroom to cross-pollinate understanding of the core ideas and problem-solving techniques; Monitor progress in real time in the class;
- Find ways to avoid costs in use of some popular in-lecture voting applications (eg. PollEverywhere, PollDaddy, NearPod), and avoid having to use (find!) Clickers.

Pre-lecture Recordings

- Screen recording of voiceover and annotation with Apple Quicktime (free for both Mac and PC)



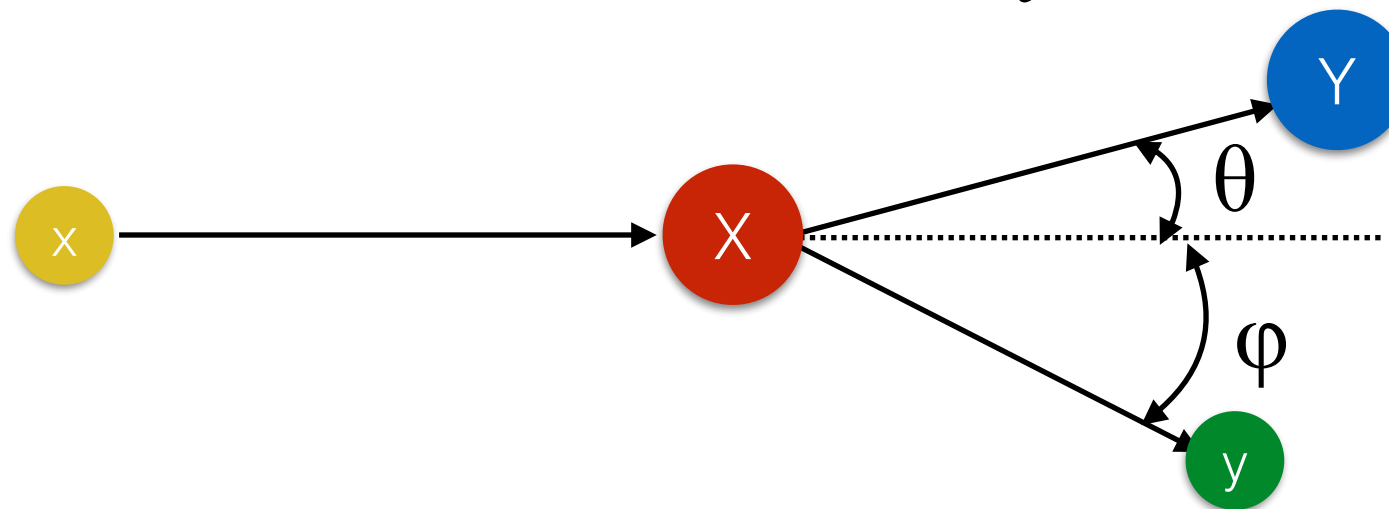
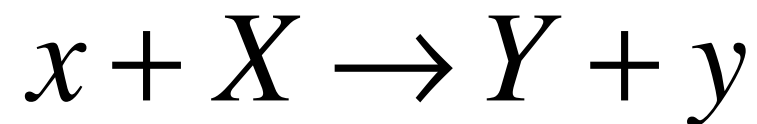
Pre-lecture Recordings

- Screen recording of voiceover and annotation with Apple Quicktime (free for both Mac and PC)
- Lecture material created in Keynote;
- Bluetooth interfacing between Mac/PC and iPhone/iPad using Keynote app. This allows control of slide movement and annotation with a stylus (Adonit Jot Pro).



Nuclear Reaction Kinematics

- While examining the rate of nuclear reactions is important, understanding the energetics of the reaction is equally important.

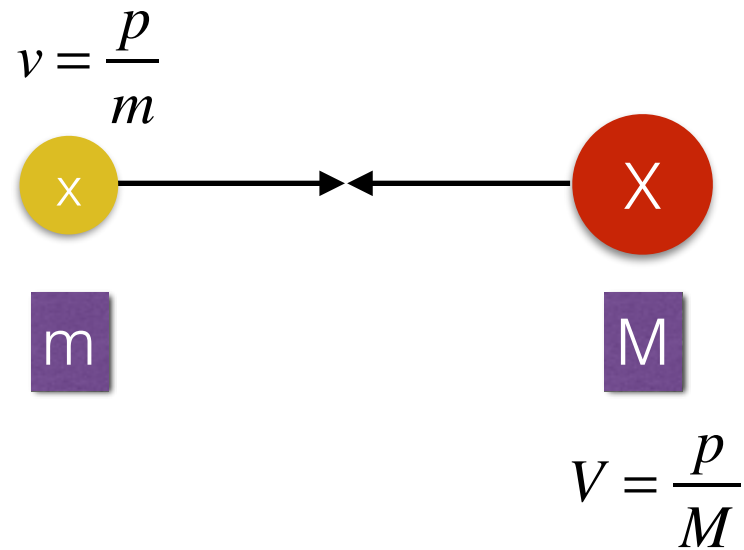


$$Q = m_x c^2 + M_X c^2 - m_y c^2 - M_Y c^2$$

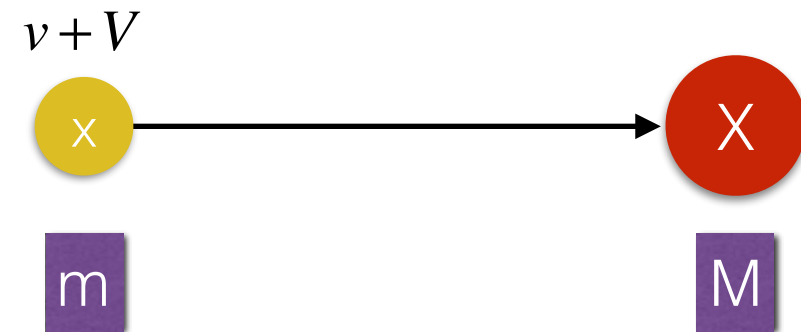
$Q > 0$ Exothermic

$Q < 0$ Endothermic

Nuclear Reactions (7) - Kinematics

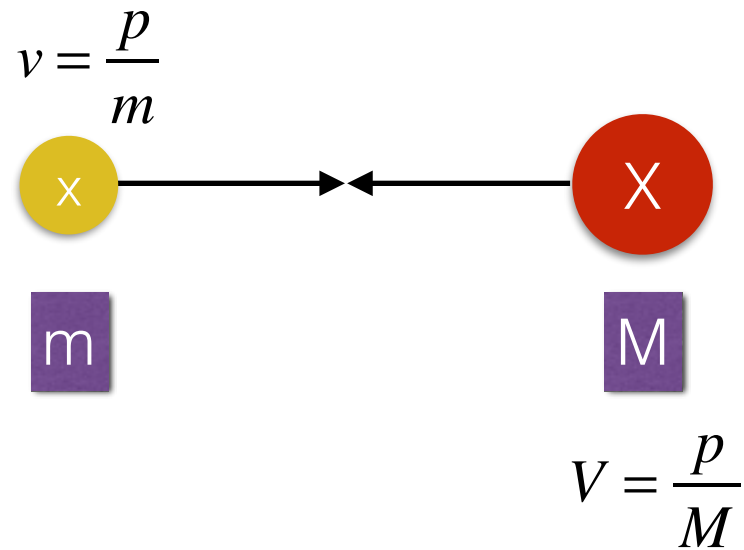


Centre of Mass Frame



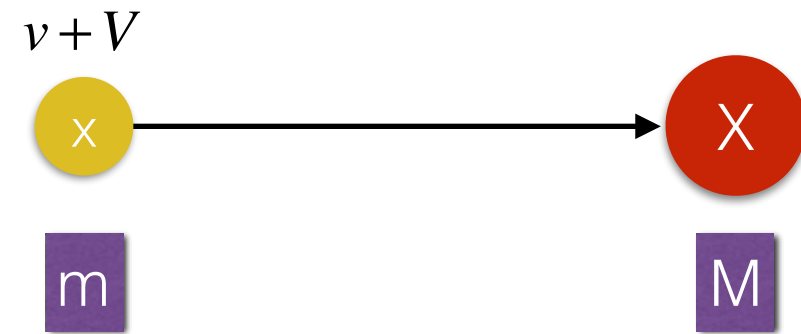
Lab Frame

Nuclear Reactions (7) - Kinematics



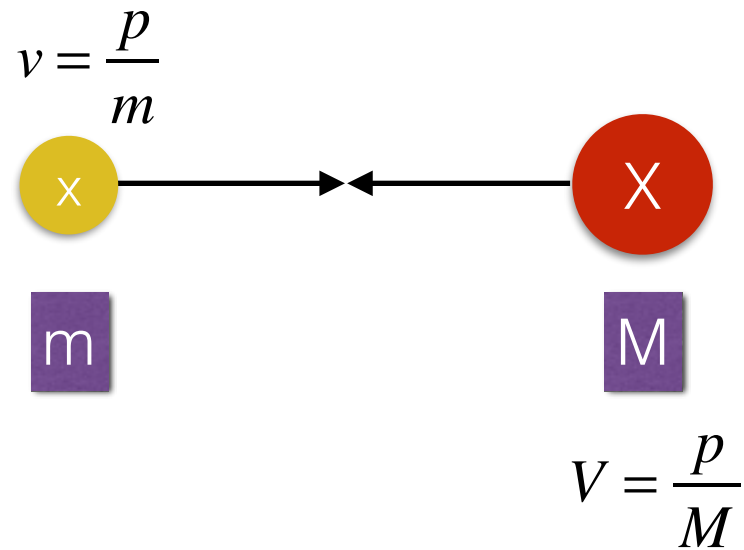
$$p = mv = MV$$

Centre of Mass Frame



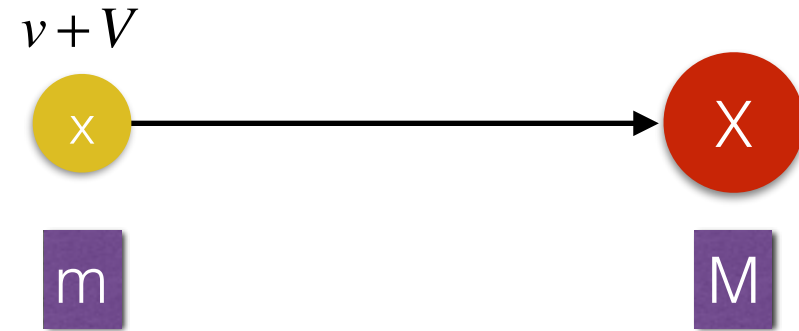
Lab Frame

Nuclear Reactions (7) - Kinematics



$$p = mv = MV$$

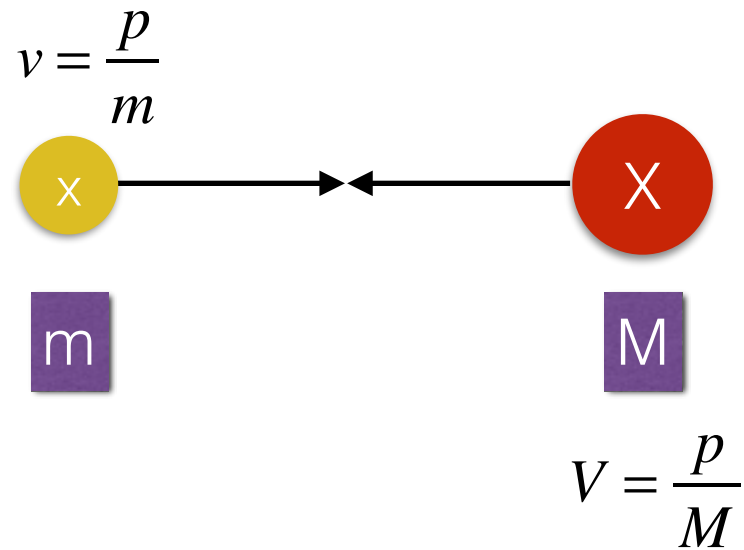
Centre of Mass Frame



$$p_{lab} = m(v + V) = mv \left(1 + \frac{m}{M} \right) = \frac{M + m}{M} p$$

Lab Frame

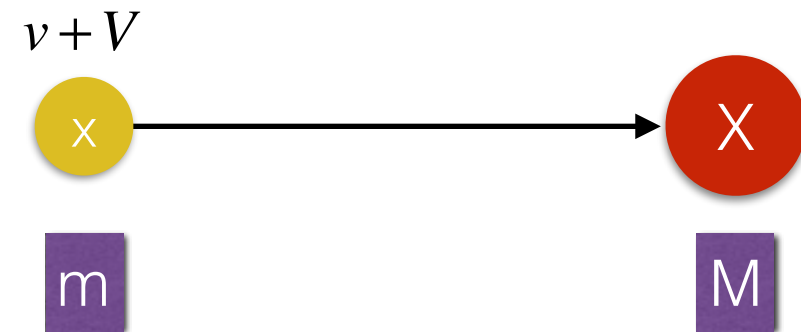
Nuclear Reactions (7) - Kinematics



$$p = mv = MV$$

$$E_{CM} = \frac{p^2}{2m} + \frac{p^2}{2M} = \frac{(m+M)p^2}{2mM}$$

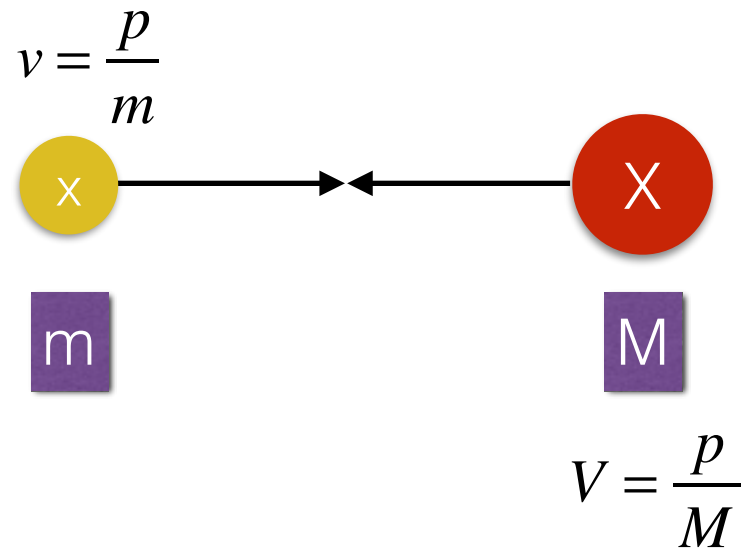
Centre of Mass Frame



$$p_{lab} = m(v + V) = mv \left(1 + \frac{m}{M} \right) = \frac{M + m}{M} p$$

Lab Frame

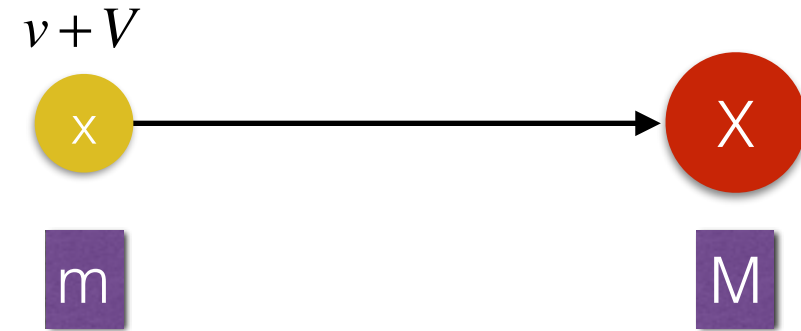
Nuclear Reactions (7) - Kinematics



$$p = mv = MV$$

$$E_{CM} = \frac{p^2}{2m} + \frac{p^2}{2M} = \frac{(m+M)p^2}{2mM}$$

Centre of Mass Frame

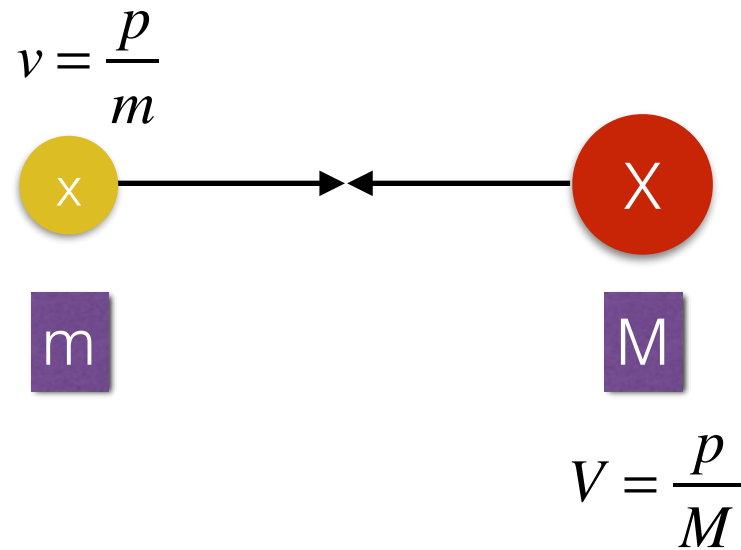


$$p_{lab} = m(v + V) = mv \left(1 + \frac{m}{M} \right) = \frac{M + m}{M} p$$

$$E_{lab} = \frac{p_L^2}{2m} = \left(\frac{p^2}{2m} \right) \left(\frac{M + m}{M} \right)^2 = \frac{M + m}{M} E_{CM}$$

Lab Frame

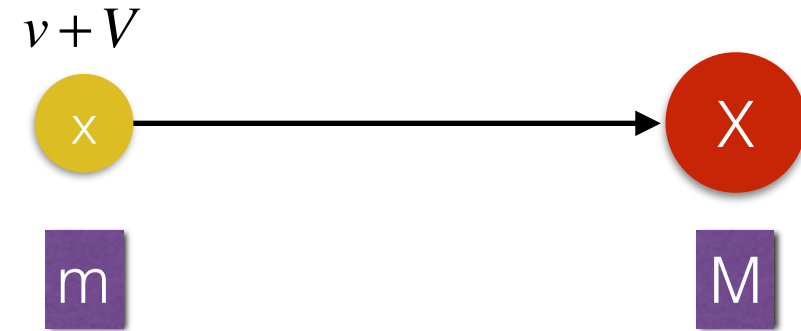
Nuclear Reactions (7) - Kinematics



$$p = mv = MV$$

$$E_{CM} = \frac{p^2}{2m} + \frac{p^2}{2M} = \frac{(m+M)p^2}{2mM}$$

Centre of Mass Frame



$$p_{lab} = m(v + V) = mv \left(1 + \frac{m}{M} \right) = \frac{M + m}{M} p$$

$$E_{lab} = \frac{p_L^2}{2m} = \left(\frac{p^2}{2m} \right) \left(\frac{M + m}{M} \right)^2 = \frac{M + m}{M} E_{CM}$$

Lab Frame

Threshold energy for a reaction

$$E_{th} = \frac{M + m}{M} |Q|$$

Pre-lecture MCQs

- Blackboard Learn 9.1;
- Comprises part of module CA mark;
- Highlight areas of conceptual/problem solving difficulty to be addressed in class;

Question 4


25 points

Save Answer

Consider an alpha particle tunnelling through a barrier. Which of the following will increase the tunnelling probability?

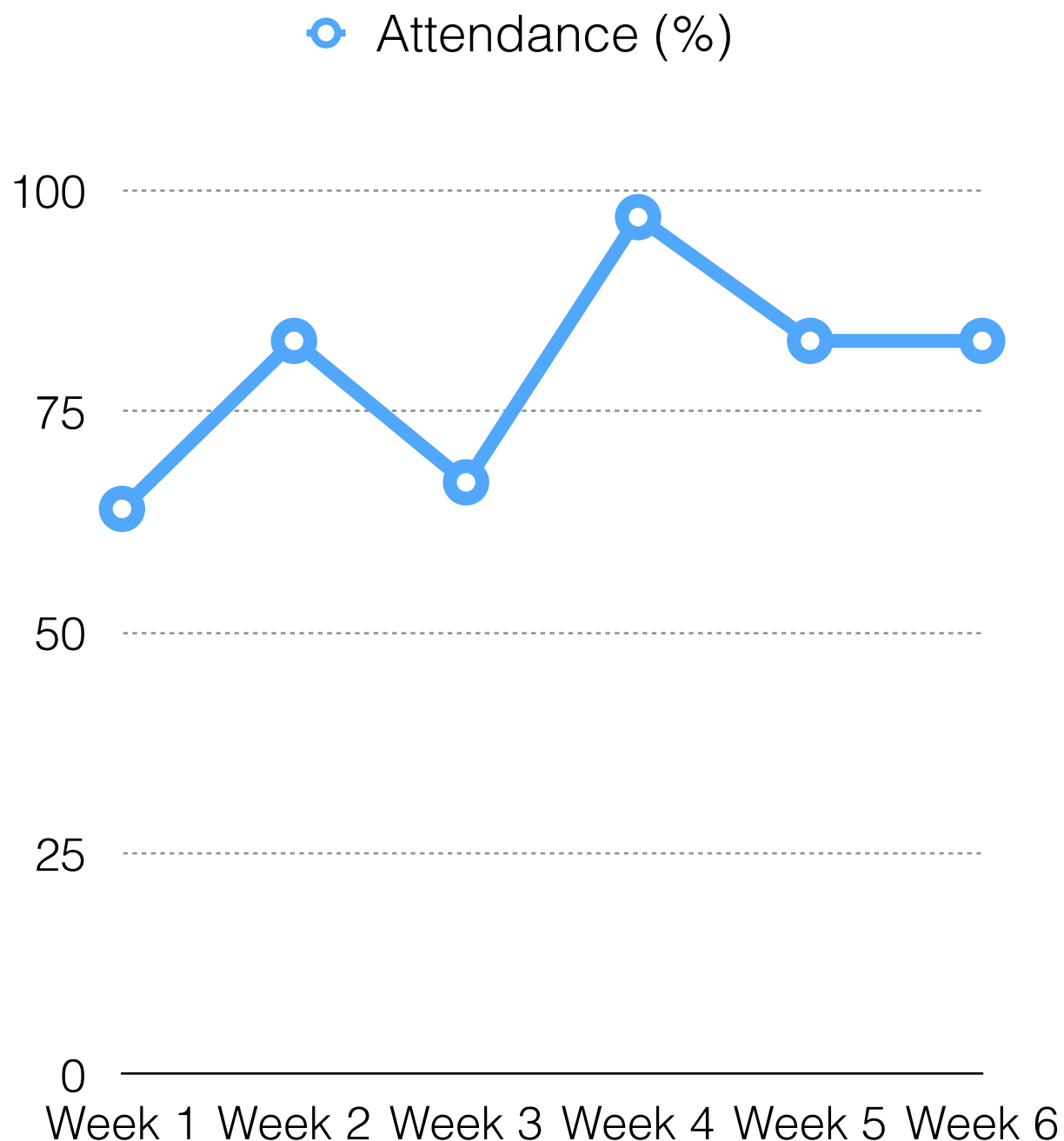
- I. Decrease the mass of the particle.
- II. Decrease the width of the barrier.
- III. Decrease the height of the barrier.
- IV. Decrease the depth of the potential well

In-lecture tasks

- Socrative; The Socrative logo consists of a blue molecular structure icon on the left, followed by the word 'socrative' in a blue, lowercase, sans-serif font. Below 'socrative' is the text 'by MasteryConnect' in a smaller, grey, lowercase font.
- Facilitated using Socrative Student/Teacher App;
- Students would log in to lecture 'room' the name of which changes with each lecture;
- Tasks ranged from timed MCQs to longer computational problems;
- Marks also counted towards module CA;

Phenomenon 11

Impact/Outcomes



Module outcomes/highlights:

- Improvement to engagement;
- Deeper learning of subject;
- Greater coverage of subject with student prep time prior to in-class lecture;
- Peer and instructor refinement of knowledge through Q+A within classroom;
- Real-time feedback to both encourage student and highlight areas for further attention;



Future Work



Future Work

- Evaluate use of in-presentation apps (Google docs, Nearpod) for assessment;

Future Work

- Evaluate use of in-presentation apps (Google docs, Nearpod) for assessment;
- Devise a way to allow students to post and discuss their problem solutions in class by uploading to lecturer (using Twitter or similar);

Future Work

- Evaluate use of in-presentation apps (Google docs, Nearpod) for assessment;
- Devise a way to allow students to post and discuss their problem solutions in class by uploading to lecturer (using Twitter or similar);
- Improve peer instruction time;

Future Work

- Evaluate use of in-presentation apps (Google docs, Nearpod) for assessment;
- Devise a way to allow students to post and discuss their problem solutions in class by uploading to lecturer (using Twitter or similar);
- Improve peer instruction time;
- Improve problem solving strategies;



THANKS





THANKS

- Frances Boylan;





THANKS

- Frances Boylan;
- The students of DT221/DT222/DT227/DT235;





THANKS

- Frances Boylan;
- The students of DT221/DT222/DT227/DT235;
- The Mobile Project team;

