

Inquiry Orientated Learning in Physics at Murdoch: A Case Study

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15min + 5min of questions



Murdoch
UNIVERSITY

The Murdoch Context

- PEC152 Principles of Physics
 - Whole cohort tutorials
 - Increase student engagement!
 - External IOL Labs
 - Reduced need for kits
- PEC120 General Physics
 - Small group tutorials
 - Increase student engagement!
- Student Demographics



Challenges to Implementation

General Challenges

- Finding appropriate activities that can be completed in an already busy tutorial schedule
- Time
 - Thinking development / implementation
 - Testing activity – students beta tested / Getting the sticky tape right!
 - Rewriting student materials and website
 - Tutor development / training
 - Tutor ability to cope with student questions via e-mail (for externals)
- Changing the uni timetable
- Eliminating clashes
- Willing tutors

Large Cohort Tutorials

- Many sets of equipment – kits and transportation to room
- Large enough room
- Confidence in your ability to manage students, be responsive to what is going on, make changes and think on your feet during the tutorial.

What we did

Small group tutorials

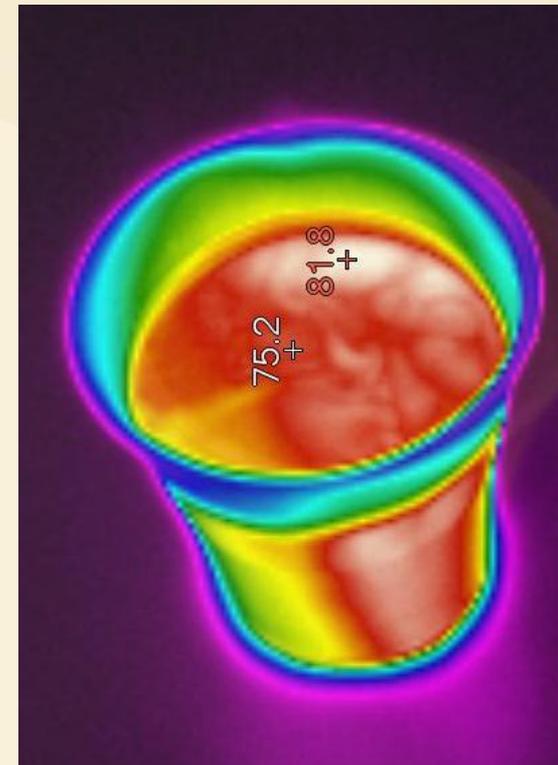
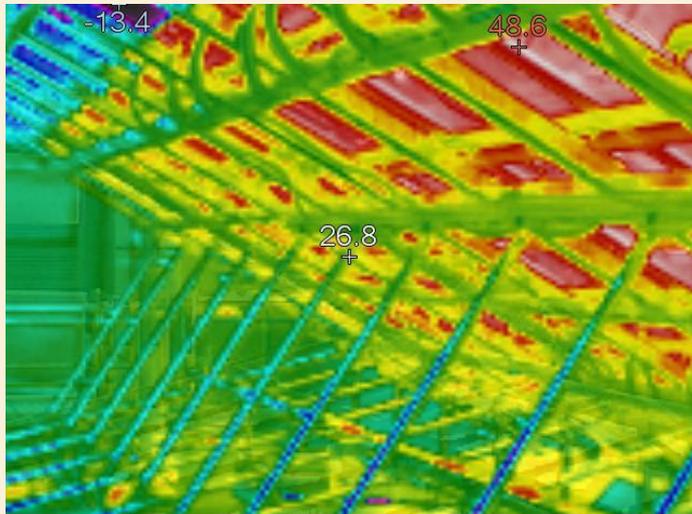
- Projectile motion activity
 - Students were challenged to find the height a projectile would go if it was fired straight upwards
 - Experimental design
 - Uncertainties in measurement



What we did

Small group tutorials

- Thermal imaging
 - Challenged to design and build a good insulator
 - Effectiveness tested using IR camera
 - Discussion on heat flow



What we did

Small group tutorials

- New activities for Renewable Energy Devices students
 - Solar energy concepts
 - Exploration of angle
 - Solar concentrators



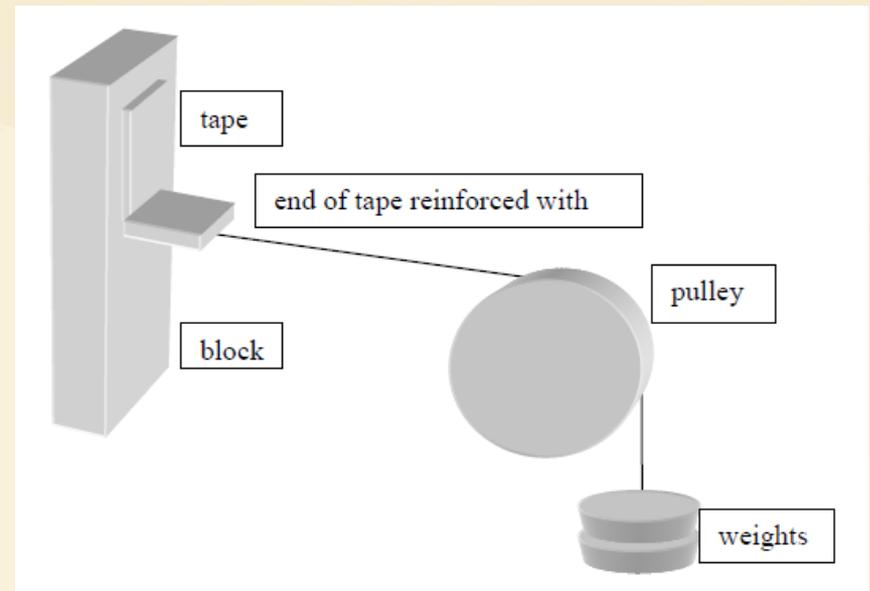
PEC621 Students investigating how to get the most power out of a solar panel

Students Expectations and Past Experiences

- My experiences have influenced my approach to teaching physics
 - life (mechanical tinkering)
 - as a physics student (1967)
 - Nuffield Physics which was part of the Nuffield Science teaching project initiated in 1962
<http://www.ioe.ac.uk/services/1001.html>
 - Practical hands-on focus
<http://www.nuffieldfoundation.org/practical-physics/teaching-and-learning>

Whole Cohort Tutorial

- Week 1 Activity 1
Experimental Design
Sticky Tape
 - No prior experience
 - No 'right' answer
 - Finding things out
- Given the challenge and left to get on with it
- 14 tables of students and the majority developed a test that was different to the one given in the book



Whole Cohort Tutorial: What Worked Well

- Some groups finished earlier than others so I got them to whiteboard what they would need to consider if they were to manufacture and market sticky tape. (extension work)
 - Excellent range of ideas including social ones like working conditions.
- Groups keeping notes in the notepad for participation marks
 - gave me feedback on what they were doing
- The lab technician had made equipment ‘packs’ which made it easy to hand out equipment

Informal Assessment of IOL

- Level of working noise in the tutorial
- Creativity of the students as evidenced in their notepads and activity
- If they are still talking about physics as they leave the tutorial
- Happiness of the tutoring staff and myself at the end of the tutorial
- Informal feedback from the tutoring staff
- My reflective journal written up the next morning

Evidence of Enhanced Student Engagement / Learning

- MOSS survey on SCI19 labs “What were the best features of his unit?”
 - Student “Having to create, design own lab experiments utilizing household objects.”

Whole Cohort Tutorial: Incentive / Motivation

- Link the IOL activities to what scientists/engineers do. **Pointy-haired boss.**
 - Sticky tape - experimental design
 - The candle – observation
 - Bouncing ball graphs and tabulated data – data analysis
 - Coefficient of friction – creativity and innovation
 - Only 2 out of 14 cook-book lab report this time!
Getting better.



External IOL Labs

- Visualise yourself as the student
- Make the activity as open as possible w.r.t. the type of equipment used
 - 1-2m incline - table, desk, length of pipe, disabled ramp, wall, banister rail etc.
 - Known weights – cans, coins, lego blocks, bricks etc.
- Provide just-in-time information
 - Responsive external tutor
 - LMS with discussion area
 - Set of FAQ's
- Making sure the activities work
 - Get people who have no idea what you are doing to have a go at the activity and write it up fully as well as give feedback
 - Mark this work as you would for a student
- Reflect on the whole thing

Embedding and Sustaining IOL

- For the current units using IOL
 - Once it is in the manual and the changes have been made it stays there if it is not a negative influence
- Encouraging other staff to give it a try
 - Ask them to help out with tutoring
 - Ask them to test the activities for you
 - Discuss your MOSS survey results and student feedback
 - Publish papers

Overall

- Enriching the student experience through inquiry? Yes
- Enriching the teaching experience through inquiry? Definitely yes
- We would like to thank Ass Prof Les Kirkup for getting us started!

Quotable Quotes

- The greatest benefit to students of introducing inquiry into the undergraduate curriculum is that it allows them to express their creativity and actually engage in the scientific way of doing things. I don't think any other student activity in first year physics; lectures, labs, calculation-like problem solving, allows them to do this. IOL activities were the missing jig-saw piece in my units. (Chris Creagh 2012)
- The benefit to me of IOL activities is that I find it is fun to work with the students using them. IOL activities give me the opportunity to discuss aspects of what scientists actually do, and what they have to take into consideration, in a just-in-time situation, with small groups of students, at the moment where the learning and teaching is most appropriate. I come out of these classes on a high, buzzing! (Chris Creagh 2012)