Training and Support of Lab Demonstrators at Imperial College.

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A brief outline of today's presentation.

- A quick overview of the Physics Department at Imperial.
- What teaching activities are PG’s and RA’s involved with?
- How do we prepare GTA’s for teaching roles?
- Generic GTA skills training run within the Physics Department.
- Half day GTA training course.
- Live marking, Q & A, interacting with undergraduates etc.
The Physics Department at Imperial College.

We host on average:

- 800 undergraduate students on a range of 3 and 4 year courses (intake ~240 students);
- 350 postgraduate students, with 100 masters students & 100 PhD students completing their studies each year;
- 180 postdoctoral researchers;
- 20 academic fellowship holders;
- 120 academic staff (~98% research active);
- 2.5 teaching fellows (new initiative);
- 100 technical and support staff.

Everyone teaches.

- All academic staff not on sabbatical, bought out by fellowship teach.
- Transparent internal market for teaching & admin time credit.
- Departmental distribution of teaching hours published, we have to bid for major roles, e.g. a lecture course.
- Teaching and admin load evenly distributed, impossible to “pull rank”. A large staff results in students interacting with senior academics at all levels from labs and tutorials to lecture courses.
- RA’s have contractual obligation to teach, “first to return the paperwork” ranking for different roles, no extra pay.
- 2nd year and older PhD students may ask for a teaching role in labs or in support of a teaching activity alongside a full staff member, e.g. assisting in small (20 student) group teaching. Paid hourly.
What roles do our GTA’s play in teaching?

- **RA Teaching roles (~120 total).**
  - Demonstrating in 1st, 2nd, 3rd year labs.
  - Demonstrating in computing labs.
  - Assisting with classworks.
  - Academic tutoring (groups of 4) years 2 and 3 only.

- **PhD student teaching roles (~150 total).**
  - Demonstrating in 1st, 2nd, 3rd year labs.
  - Demonstrating in computing labs.
  - Assisting with classworks.
  - Assisting with small group teaching.
  - For PG’s most “live” teaching done along side senior staff.

How do we prepare our GTA’s for teaching?

- **Formal College requirement for GTA training before taking on a UG teaching role.**
- **Technical training**
  Managed by individual lab, experiment or course heads. Deals with the “nuts and bolts” aspects of a particular role, including course specific assessment, safety rules, lab practice etc.
- **Generic training**
  Centrally run web based support. [http://www3.imperial.ac.uk/edudev/resources/gtamaterials/trainees](http://www3.imperial.ac.uk/edudev/resources/gtamaterials/trainees)
  Centrally run workshop covering marking, feedback etc.
  Departmental “half day GTA training session – what I am going to concentrate on today.
How do we make sure GTA’s attend?

- Stick and carrot approach. GTA’s are required to attend but lunch and coffee is provided for a ~ half day training session.
- Marking exercises sent out in advance as a prompt, GTA’s are told that we expect them to attend with these done so that they can be reviewed in the session.
- Occasional GTA’s claiming they are “too busy” told to ask their Head of Group to find a replacement for their teaching load …… this does not typically work out too well for the GTA.

Introduction to the Departmental GTA training session.

Structured as a series of short, mostly interactive exercises. We begin by highlighting the benefits of teaching well –

- CV and career building.
- New learning opportunities.
- Avoiding the embarrassment of ignorance displayed in front of an unforgiving audience (undergraduates).
- Credit given for PhD students required total of transferable skills (GSEPS) courses.
- Payment for PhD students.
### What makes the “ideal” tutor or lab demonstrator.

- Small team exercise, typically ~5 GTA’s per group.
- Groups asked to agree the top 6 characteristics of an “ideal” tutor, lab demonstrator, computing demonstrator, 1st year project supervisor, final year project supervisor.
- Teams asked to read out their choices, collated on the blackboard.
- Follow up group discussion on the merits of the various choices made, common themes identified.

### How to approach and interact with undergraduates.

- Begins with a short (10 minute) lecture on the role of a demonstrator in guiding learning, assessing work, providing feedback, ensuring good lab book practice, meeting deadlines etc.
- Highlights the need for technical skill on the assigned teaching activity – details handled elsewhere, e.g. teaching labs.
- Stresses need to be proactive, don’t assume all is going well if you don’t get asked questions.
- Gives examples of “leading” questions to draw out students and technical issues to raise in discussion, e.g. error calculations, agreement with theory etc.
Example situations for role play, all based on real examples.

- My partner knows what we are doing so why don’t you ask my partner how we are getting on? In fact, I’ll ask – where have we got to?
- SILENCE... and maybe no eye contact... thinks - I’m going to sit here and say nothing my partner can be relied on to do all the talking.
- I’m a theorist – I’ll sit here and think about the theory while my partner handles the equipment.
- I’m not going to a physicist so why do I have to do this anyway?
- My tutor wants this handed in at lunchtime so I’m working on this and I’ll come in some other time to do the lab.
- I’m hung over, it was my birthday yesterday – I’ll just sit here, please go away.
- I’d rather work with these people, they don’t mind my partner can work alone...
- My partners always late so I’m not doing anything yet.
- RAISED VOICES My way of doing it is right ... No – mine is.. no it isn’t mine is..
- We share a flat but we have had a fight so we’re not talking and we are taking it in turns to do the experiment.
- My lab partner and I have been a couple since the first day at College but we’ve split up and I’m upset and I’ve come to lab but we’re not working together.....sob.

Report Marking Exercises.

- Highlights need to hit deadlines and provide sufficiently detailed feedback on written work.
- Two reports, one reasonably good, one a hideous encyclopedia of past student errors provided in advance for marking.
- Board exercise, marks from the GTA’s collated on the board followed by a short discussion on marker to marker variation, using the available dynamic range when marking etc.
- Run through my marked versions of the reports highlighting level of detail expected.
- Follow up discussion on how to identify problem students, handle late reports, suspected plagiarism etc. When to hand over to a more senior member of staff.
Example marks distributions from staff working in the same teaching laboratory.

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<td>78 ± 12</td>
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- Helps to calibrate GTA’s, average marks for lab work are typically higher than for examinations.
- Highlights the need to use the available dynamic range.
- Helps highlight support for GTA markers, e.g. in 2nd year lab heads of experiment hold moderation meetings to agree marks.

wavelength of light the optical scattering is described by Rayleigh scattering. Clusters were formed by expanding argon gas into vacuum through an electrically controlled valve and a green laser was focused into the gas stream and scattered light detected with a PMT.

Theory
Cluster Formation

There is no rigorous theory of cluster formation in a gas stream and first principle calculations of the size of clusters expected are currently impossible. However a semi-empirical scaling law based on the so called Hagen Parameter \( \Gamma^* \) [3] allows the cluster size to be estimated.

\[
\Gamma^* = \frac{k (d / \tan \alpha)^{0.83}}{\rho_0^{2.2}}
\]

(1)

where \( d \) is the nozzle diameter in \( \mu m \) and \( \alpha \) the expansion half angle (\( \alpha = 45^\circ \) for a sonic nozzle and \( \alpha < 45^\circ \) for a supersonic expansion). \( \rho_0 \) is the backing pressure in mbar, \( T_0 \) the initial gas temperature before expansion and \( k \) is a constant dependant on species of the gas, for argon \( k \) has a value of 1650.

Clustering is a function of \( \Gamma^* \) and clustering generally occurs when \( \Gamma^* > 300 \). After this point the number of atoms \( N_c \) per cluster increases as \( (\Gamma^*)^{2.025} \). Equation 1 shows that \( \Gamma^* \) scales strongly with both temperature and pressure, and lower initial temperatures and higher pressures both increase cluster size.

For more theory in content of experiment and highlights what you expect to happen on final read through.
Physics Lab Specific Q and A session.

- A short introduction to dealing with student questions followed by a quick fire Q and A session – with me playing the role of student.
- All the GTA’s get at least one question fired at them.
- Emphasise need for technical expertise plus good understanding of how teaching is organised, lab deadlines, when to ask for help etc.
- We highlight that students are quick to pick up on a lack of technical knowledge or unwillingness to help – as will heads of lab.
- Follow up discussion - a combination of technical expertise, tact, and diplomacy required, knowing when not to answer the question, when to point the student to the library, senor tutor etc.
Example questions for the Q & A session.

Q. Will I lose marks if I ask you a question?

A. No, it’s what demonstrators are for!
A. A good question can show that you are thinking about the experiment.
A. Some lab scripts actually tell you to discuss things with a demonstrator.
A. For 3rd years – Only if you keep asking really stupid ones!

Discussion - Make sure that students know what you are in the lab for – i.e. to help them as well as mark their work.

Example questions for the Q & A session.

Q. My report hand in date falls on a holiday – what should I do?

A. Report deadlines falling over a holiday are set to a few days after the start of the next term.
A. For 3rd years – Read the website.

Discussion - Know where to find this sort of administrative detail.
Example questions for the Q & A session.

Q. The lab script is rubbish!

A. What don’t you follow – is the text unclear.

A. Have you worked through the early sections to make sure you can understand the later ones?

A. For 3rd years – Some lab scripts are designed that way, we even put errors into them on purpose to see how good you really are!

A. Lab script? Luxury..... Real experiments don’t come with a lab script!

Discussion – A good opportunity to explain how research outside the carefully controlled environment of a teaching lab work.

Example questions for the Q & A session.

Q. I did the wrong measurement – now I have to do the whole thing again!

Q. My interferometer wobbles so I can’t get any fringes!

Q. What are the technical specs of a 1N4004?

Q. How do I derive a $1/C^2$ scaling from the Schockley equation?

Q. How do I get full marks on a lab report?

Q. Can I have a deadline extension?
Conclusions.

- Feedback from GTA’s generally indicates that they find this session (surprisingly) useful and enjoy some of the role play.
- “Live” marking and Q & A sessions help GTA’s get involved in steering parts of the training session.
- The interactive nature of many of the exercises help to draw out the experiences of more senior demonstrators and kick start discussions.
- The more administrative and pastoral aspects of the GTA role often come as a surprise to new demonstrators, the session helps to clarify this, and highlight when and how to ask for staff support.

End.

Questions and comments?