



## Overview & Issues

(compiled by David M. Harrison. Last revision March 13, 2005. The most recent revisions are underlined below.)

We propose combining the first year tutorials and laboratories into a single series of *Physics Practicals*.

The principle goals of this project are:

- Develop conceptually based activities to aid student understanding of material being discussed in their class.
- Introduce methods of experimental science as a natural companion of the theoretical aspects discussed in the classroom.

Studies of 12 and 13 year old students indicate that such a merging of thought experiments with actual experimentation can be beneficial.<sup>1</sup>

There are many issues that need to be addressed. A partial list includes:

- Which courses. So far we have been largely concerned with PHY110 and PHY138. Should we be thinking about other course now? If so, which? Currently there seems to be agreement that we should keep our focus on these 2 courses.
- The timeline. When do we expect to go “live” with these practicals? When should work begin on developing educational materials? When should the physical plant renovations be done? A “best case” timeline appears below.
- Budget. There will be significant costs associated with both renovating the physical space and new equipment. What is the total dollar cost and where do we get the money? A starting point will be finding out how much the recent renovations to the 1<sup>st</sup> year Chemistry lab cost.
- Development personnel. Developing the modules will require significant time and effort. Who will do this work? Will this involve releasing people from their normal duties?
- Timetable. Currently student average 2.5 hours per week in tutorials and labs. What number of hours per week will the students spend in the practicals? We will need 2 practical sections per day to handle all the students. What times should these be held?
- Staffing requirements. What are the implications of the practicals on the workload of our technologists? One current design has 20 students in each practical group.

Should each group be handled by a single TA? Two TA's per group? A rough calculation of TA hours appears below.

- Are we obligated by our agreement with the TA union to keep the total number of TA hours the same?
- Should we try to organize a visit to Priscilla Laws' group? If yes, who will go?
- Many other institutions doing this sort of thing typically have 4 students working together instead of the 5 students in our proposal, while a few have 3. What is the optimal number of students? Priscilla Laws says 3, but her groups typically have 4.
- At least a significant fraction of the last Practical before a test will be devoted to preparation for the test. Thus each Practical group must be for a single course only.

### **Best Case Timeline**

1. May 2005 – proposal goes to the Dean
2. Oct 2005 – funding secured, development of teaching modules begins
3. Apr 2006 – construction begins
4. Sept 2006 – ready

### **TA Hours**

Currently the TA hours in support of PHY110 and PHY138 are:

- Labs: 4,812 hours
- PHY110 Tutorials: 885 hours
- PHY138 Tutorials: 2,496 hours
- **TOTAL:** 8,193 hours

Assuming a 25-week academic year, this is 328 hours/week. This number includes training, marking and test invigilation, etc., so is not contact hours.

For the new Physics Practicals assume:

- 2 hour duration
- 105 groups with a maximum of 20 students each.
  - 100 groups are during the day, 2 sections each day
  - 5 are for the evening section.

Thus, we will have 105 groups x 2 hours per session = 210 contact hours/week. If each group has a single TA, adding in training, marking, invigilation etc. makes this proposal somewhat less expensive than our current situation.

It could be educationally very valuable to have 2 TA's in each group. One scenario could be:

- 63 groups of 30 students each.
  - 60 groups during the day
  - 3 groups in the evening

This reduces the maximum number of students that can be accommodated from 2,100 (2000 during the day, 100 in the evening) to 1,890. But if we have 2 TA's per group we would have 63 groups x 2 hours per session x 2 TA's per group = 252 contact hours. Adding in the non-contact overhead would make this scenario roughly neutral in terms of total TA hours required.

This would involve a complete re-design of the current Physical Plant document. Is it worth exploring this further?

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<sup>1</sup> Miriam Reiner and John K. Gilbert, "The symbiotic roles of empirical experimentation and thought experimentation in the learning of physics," *International Journal of Science Education* **26**(5), 17 December 2004, pgs 1819 – 1834.