

# Quality Implementation Plan for the Department of Experimental Physics

This plan was approved following a meeting of the President and Acting Head of Department on 27<sup>th</sup> June 2011.

## 1. Recommendations which the Department could implement unaided

### **Recommendation 1.1 (Section 4.4: Teaching, Learning and Assessment)**

We recommend that the Department take steps to address the gap between students with weak and strong preparation in mathematics and physics. It may be possible to address this issue without further straining resources. For example:

- Make use of the remedial mathematics programme offered by the Mathematics Department to address weaknesses in the mathematics preparation of incoming students.
- Consider using some material from the existing Foundation Year NUI Certificate in Science to address the problem of inadequate physics background in incoming students. This could be implemented through some kind of placement of students into parallel but separate streams in the first semester that could be combined at a later stage. This could allow students with weaker preparation to catch up, while keeping the stronger students engaged.
- Work with the Department of Mathematical Physics to streamline existing modules that currently have significant overlap. Solid state physics was presented to the committee as an example of a subject that is separately taught by each Department, with important differences in emphasis, but nevertheless with a large degree of overlap.
- If possible increase the use of continuous assessment to train students in time management and to ensure consistent effort.
- Consider how to evaluate the effectiveness of innovative e-learning teaching methods to maximize use of resources.
- To maintain consistency for students in the crucial early stages of a degree, consider restricting the teaching activities of postgraduate students to lecture courses in later years.

**Actions:** In line with the suggestions of the committee to address the gap between students with weak and strong preparation in mathematics and physics we will implement the following strategies:

- A member of staff will be given responsibility for liaising with the Mathematics “drop-in centre” (run by the Mathematics Department) to highlight the particular areas of weakness in the mathematics preparation of incoming students to First Year Experimental Physics. Students who need help will then be directed to the centre.
- We are also planning to implement a First and Second year virtual (Moodle based) drop-in centre specifically for physics where students can get help with areas of physics or the associated mathematics that are causing difficulty. This will also offer students in general an opportunity to see what areas of the course material are presenting problems.
- We are also addressing the issue of the difficulty students have with the level of more advanced mathematics required in the later years of the degree programme. Last year we implemented a special course in 4<sup>th</sup> year, which covered the main areas of mathematics required for the course. Students found this course very valuable in

underpinning the theory courses. In the forthcoming academic year (2010/11) we are extending this into the 3<sup>rd</sup> year. This course is taught as part of a problem-based laboratory with homework exercises to ensure student participation. This also addresses the recommendation of using continuous assessment to train students in time management and to ensure consistent effort as there is emphasis on regular homework submission. Students are required to tackle problems individually and in small groups both under supervision and unsupervised.

- We will also make available some material from the existing Foundation Year NUI Certificate in Science EP001 (through Moodle) to address the problem of inadequate physics background in incoming students. While it would be ideal to implement this through placement of students into parallel but separate streams in the first semester that could be combined at a later stage (as suggested by the peer review committee), we do not have the resources to implement this at the moment. Furthermore the Foundation Year in Physics of the NUI Certificate is now taught only in the 2<sup>nd</sup> semester, (see also 3.1 below). Nevertheless, the material presented is essentially at the same level as the first eight weeks of EP102.
- As recommended by the Peer Review Report, we are continuing to explore ways in which we can work more closely with the Department of Mathematical Physics to streamline any modules that have significant overlap. .
- We will consider how to evaluate the effectiveness of innovative e-learning teaching methods to maximize use of resources and discuss related issues as part of our teaching committee research work. We are planning to introduce PHYSLET type interactive e-learning material in the 2<sup>nd</sup> year Modern Physics course to allow students to individually revisit and explore actual hardware demonstrations used in teaching this course.
- From this year (2010/11) we will restrict the teaching activities of postgraduate students to lecturing courses in later years of the Experimental Physics degree programme.

#### **Recommendation 1.2 (Section 4.4 Teaching, Learning and Assessment)**

There is a system in place to collect student feedback on lecture courses, but it is unclear to students what is accomplished by their feedback. We recommend:

- The Department should consider how best to publish student questionnaires on lecture courses. For example, some minor comments that the committee heard could be addressed by “closing the loop” to show how student comments have been acted upon. This includes a comment that the weighting of lab component as a fraction of final grade should reflect expended student effort.
- The Department may wish to solicit student feedback at regular intervals during the course as well as at the end of the course.

**Response of Department:** The Department will address the issue of feedback to students on issues raised in student questionnaires through the Staff-Student Committee (comprising Class Representatives, Course Coordinators and a Chair). This we feel is the ideal forum for “closing the loop” on student feedback. We plan to implement a scheme in which the feedback from different courses is summarised and discussed by the Departmental Teaching committee before providing feedback to students. In this regard we can use the Engineering template as an online survey having addressed at least some of the students’ key concerns. We will implement regular feedback opportunities also during courses, and consider issues associated with workloads and uneven weighting of marks for effort. Lecturers and Course Coordinators will, at regular intervals during 1st and 2nd semester, remind students that they

can approach the lecturers and/or the course coordinator if they wish to raise issues of concern. Students can also approach the class representatives, who then have the options of raising the issue at one of the staff-student committee meetings, or arranging a meeting with the course coordinator if the issue needs to be dealt with at short notice.

### **Actions**

- The Head of Department will meet with the Director of the Centre for Teaching and Learning to discuss the issue of student feedback on courses.
- Regular meetings will be organised between Course Coordinators and Class Representatives. Students will be encouraged to raise issues of concern with lecturers.
- Concerns raised by students at the Staff-Student Committee will be discussed at the following Departmental Teaching Meeting and responses given to students at Committee and class co-ordinator meetings.

### **Recommendation 1.3 (Section 4.4)**

The Department should improve career advising for both undergraduate and postgraduate students in the context of a changing economic environment. A physics degree remains excellent preparation for a range of careers including emerging areas such as biophysics and the so-called “green sector”, but enabling students to take full advantage of opportunities may require a different approach to advising. It may be appropriate to investigate whether new internship programmes would improve student job prospects in a difficult economic climate.

**Response of Department:** The Department will appoint one of the academic staff members to specifically deal with career advice for both undergraduate and postgraduate students. It is proposed that the excellent services of the Institute of Physics also be employed in this regard and students be made aware of the specific value of an education in physics for high value jobs in the marketplace. At the moment the Department does have a limited internship programme involving a double honours degree with computer science. This could be extended as well as more use made of the University Placement Officer through the efforts of a dedicated member of the academic staff. It might be possible to invite past students to submit brief commentaries (to a well defined format) on their career progression and present these on a blog as guidelines for existing students.

### **Actions**

- A member of staff will be assigned to deal with careers advice for Physics students and to liaise with the University Placement Officer.
- The resources of the Institute of Physics and past students will be used to provide examples of career paths in Physics.

### **Recommendation 1.4 (Section 4.4: Research)**

The committee strongly endorses the departmental goal of protecting research time, especially for younger staff members. The University should help the Department to ensure that teaching staff are given adequate time for research, including sabbatical leave.

The committee also endorses the departmental goal of encouraging staff to develop common research programmes in order to maximize use of resources. This has worked extremely well for the Space Terahertz group for example. Similarly, efforts to develop research ties with other departments are commendable and should be encouraged to spark new research directions. The ICARUS collaboration is a good example.

**Response of Department:** The Department has as a goal the encouragement of staff to undertake research and a teaching allocation model is being used that gives due weighting for research and graduate student supervision in particular. The big disadvantage with sabbatical leave is the financial cost of the salary decrease to fund substitute teaching. Unfortunately, the university has recently had to suspend a scheme for helping young academic staff in this regard in order to save money in the constrained financial climate. We look forward to the reintroduction of the scheme in the near future.

### **Actions**

- The Department will continue to support new international research collaboration initiatives through financing travel and facilitating absences during term time by flexible timetabling of lectures (while ensuring no disruptive impact on the learning experience of students).
- The Department will also actively encourage collaborative engagement in Physics Education Research, with a view to publication, through the medium of Action Research Projects similar to those recently completed by staff members for the PGDHE (Post Graduate Diploma in Higher Education).

### **Recommendation 1.5 (Section 4.3 Research)**

The committee recognizes the quality of the departmental research, including the strength of the postdocs and students. However:

- The number of postdocs is small, most likely due to funding issues, which is likely to affect research productivity.
- The publication list included a higher ratio of conference to refereed publications than is ideal. Work is presented at international conferences, which speaks well of its quality, but the absence of follow-up papers in refereed journals suggests that the work cannot always be written up in a timely manner.
- The pressure on the time of the academic staff is preventing young faculty members from taking sabbatical time, a necessary requirement both for the development of their research programmes, and for avoiding burnout.

**Response of Department:** Due the nature of the research carried out by the majority of the department, the relative number of conference to peer-reviewed papers can vary significantly over a number of years e.g. during the design phases of an instrument there may be a moratorium on publication in journals. A number of experiments have begun operation since the Quality Review and consequently the number of peer-reviewed papers published by staff and graduate students in the department has increased several-fold redressing the balance referred to here.

### **Actions**

- The Department will endeavour to increase the number of postdocs. This can be achieved through targeted programmes like Marie Curie Fellowships, IRCSET postdoc fellowships etc, and additionally by applying for grants that allow for the hiring of post doctoral research staff (e.g. European Space Agency PRODEX awards, for example).
- We will address the aspiration to convert conference proceeding papers into journal papers by encouraging graduate students to undertake such work as part of their training before the submission of their theses. We will monitor the relative number of peer-reviewed and conference papers.

- The need to provide more time for research to research active younger members of the Department is addressed in Recommendation 1.4 above.
- The department will encourage collaborations with other research groups within the EU and internationally, to allow students and post-docs to make sort visits to other laboratories, and also to encourage visitors to come to NUI Maynooth for short periods.

#### **Recommendation 1.6 (Section 4.4: Management and Future Plans)**

A detailed plan to deal with the expected reduction in core funding was not presented in the self-assessment document. It is recommended that the departmental leadership develop a clear plan for how the Department will deal with the expected reduction in core funding.

**Response of Department:** The Departmental leadership has developed a strategy for dealing with the reduction in core funding and the plan has been in effect during the past year. In additions, the Department expects to benefit from the expected savings achievable from central and sectoral procurement agreements organised by the Procurement Office, e.g. gas supply and laboratory consumables.

#### **Actions**

- The Head of Department and the Chief Technical Officer regularly monitor expenditure across all headings, and meet monthly to review and ensure that spending is within budget. Particular attention is paid to cost categories that are greater than €10K per annum on average over the last 3 years. A review of consumables, software licenses and equipment spend is underway.
- The Head of Department and the Chief Technical Officer have identified cost categories to which a reduction will be applied, to match the reduction in core funding with as little effect on the mission and core activity of the Department as possible.
- Year Co-ordinators, Office Administrator and Workshop Managers are asked twice yearly at the departmental meeting to submit a list of main requirements for laboratories, office and workshops. This list is then costed and prioritised by the Head of Department and the Chief Technical Officer. Authorisation to proceed to procurement is given only after careful consideration of the cost and the need for the particular items.
- Upgrading and replacement of computers in the main departmental computer laboratory and offices will be phased in over a longer timeframe.
- Budgetary issues are a key item on the agenda at Departmental meetings of all staff. Staff are kept up-to-date on the budgetary situation and are asked for suggestions on how to achieve savings across all areas of the department.
- Where expenditure can be charged to non-core funding this is implemented. For instance research grants are now charged for the use of departmental software licenses and the schools programme is funded by sponsorship from Intel, Yakult and a student contribution.
- The courses delivered by the department are monitored to see if any rationalisation is possible (e.g. combining the 1<sup>st</sup> year Physics course for Science and Engineering students).
- The head of Department will meet with the Management Accounting Officer to discuss and then monitor the full economic costing of the department.

## **2. Recommendations which the Department could implement only with assistance from other bodies within the University and without cost implications**

### **Recommendation 2.1 (Section 4.4, Teaching, Learning and Assessment)**

Assuming that sufficient resources are available we suggest:

- Increasing the offering of optional course modules to cover subjects at the interface between physics and other fields e.g. medical physics, climate change. To maximize available resources, it is recommended that such offerings are developed in close collaboration with other departments.
- Consider developing an MSc in Physics & Education to provide a trained workforce that can fill future anticipated gaps in the teaching profession. Again, this should be implemented using *existing* course offerings as far as possible.

The proposed links with other universities to develop a taught graduate programme are commendable but should be examined in the context of shrinking resources.

**Response of Department:** The Department has as its longer term goals the introduction of optional modules to cover interdisciplinary areas such as environmental physics, medical physics and climate change. Exploratory discussions have begun with members of the ICARUS Group in relation to climate change, but these are at a relatively early stage. Potential exists for an environmental physics option which would be very valuable for students taking a Double Honours in Experimental Physics and Chemistry. Medical physics could be an interesting option for students taking a Double Honours in Experimental Physics and Biology. The number of students taking these Double Honours combinations is small at present, and the work involved in providing a new option would have to be carefully weighed against the benefits for such a small number of students. Both Medical Physics and Climate Change have been introduced as topics in existing final-year modules.

The suggestion of an M.Sc. in Physics and Education is one that resonates with many members of the departmental staff. A key question in this regard will be whether there will be a demand for such a course despite its desirability from the standpoint of improving the quality of education in physics in Ireland. The B.Sc. in Science Education which was introduced in 2008/2009, now has students in the third year, and is attracting high calibre individuals. It would seem prudent to graduate at least one cohort of these students before embarking on the M.Sc. programme proposed. In the interim, we will initiate discussions with colleagues in the Education Department here in NUIM to try to establish the level of demand that might exist for such a programme. Physics teachers in secondary schools who want to upgrade their qualifications represent one potential source, but it is likely that they would undertake their study on a part-time basis. The emphasis in this case would be on the physics modules. A second potential group could be physicists with industrial experience who wish to enter the teaching profession. The emphasis in the latter case would clearly be on education modules.

The Department will introduce a taught Postgraduate Diploma programme (to begin 2011/12) and education modules will be available as optional modules within the programme (both generic skills modules associated with teaching, and departmental modules associated with laboratory demonstrating). It may also be possible to make use of some existing PGDHE modules.

We are actively involved in the Dublin Region Higher Education Alliance and have developed and benefited from shared postgraduate courses as part of this.

### **Actions**

- We will explore the possibility of collaborating with other departments to offer interdisciplinary module components.
- We will monitor the success of the new B.Ed programme in providing trained Physics teachers at secondary school level.

### **3. Recommendations which the Department could implement only if additional resources are provided by the University**

**Recommendation 3.1 (Section 4.4: Teaching, Learning and Assessment)** (please refer to Recommendation 1.1 above also)

We recommend that the Department take steps to address the gap between students with weak and strong preparation in mathematics and physics. It may be possible to address this issue without further straining resources. For example:

- Consider using some material from the existing Foundation Year NUI Certificate in Science to address the problem of inadequate physics background in incoming students. This could be implemented through some kind of placement of students into parallel but separate streams in the first semester that could be combined at a later stage. This could allow students with weaker preparation to catch up, while keeping the stronger students engaged

**Response of Department:** We will make available some material from the existing Foundation Year NUI Certificate in Science to address the problem of inadequate physics background in incoming students. While it would be ideal to implement this through placement of students into parallel but separate streams in the first semester that could be combined at a later stage (as suggested by the peer review committee), we do not have the resources to implement this at the moment. Also the foundation year in the NUI Certificate in Physics is now only taught in the 2<sup>nd</sup> semester, so would not be as useful in supplying this resource (see also 2.1 above). The material presented in the CERT module EP001 is essentially at the same level as the first eight weeks of EP102 – weaker students could attend the CERT tutorial in physics each week which is presented at a very easy pace if timetabling restrictions allowed.

### **Action**

- The Department will make Certificate in Science tutorial and materials available to 1<sup>st</sup> year Science students where required.
- We will contact the Director of Teaching & Learning to investigate whether innovative ways of teaching Physics (e.g. problem-based learning in tutorials) could be introduced in 1<sup>st</sup> Year and whether the Mathematics Support Centre could provide specific support to Physics students.

### **Recommendation 3.2 (University Procedures and Services)**

Although these are not departmental services, they were raised as concerns by students and so we mention them here as issues that the Department should be aware of.

- The career office accessibility was a concern among 4th year undergraduates

- The post-graduate office accessibility was a concern among postgraduates especially in light of the very bureaucratic national admissions procedure for PhD students.

**Response of Department:** Career office accessibility has been identified as an area of difficulty by the university itself and improvements can be expected in the near future.

**Action**

- We will convey the concern of the postgraduates in connection with the bureaucratic nature of the postgraduate admissions and post-graduate office accessibility to the postgraduate office.

---

**Professor Tom Collins**  
**President**

---

**Dr Cr  idhe O’Sullivan**  
**Acting Head of Department**