University College Dublin

Quality Improvement Plan

School of Physics

July 2011

Contents

1. Introduction

The Quality Review of the School of Physics was undertaken during the 2009-10 academic year, with the Review Group's visit taking place from April 27th-30th, 2010. The final report was sent to the Head of School on February 4th, 2011.
The extensive changes that have taken place in the School of Physics since 2005 made this review timely. The School of Physics wishes to thank the Review Group and the UCD Quality Office for the thorough and professional conduct of the Quality Review process. We believe the report recognises both the challenging environment for the discipline of physics and the efforts being made by the School to confront these challenges and indeed, succeed, in such difficult circumstances. The number of PhD students has tripled since 2005. All academic staff are research active, publishing in high quality international journals. There are 6 SFI PIs, 3 SFI Co-PIs and 15 SFI RFPs currently on-going. The School welcomes the recommendations made by the Review Group and this Quality Improvement Plan sets out the actions planned in response to these recommendations.

The Quality Improvement Committee consisted of:

- Chair & Head of School: Prof. Lorraine Hanlon
- Deputy Chair: Prof. Padraig Dunne
- Head of Subject: Prof. Gerry O'Sullivan
- Head of Teaching & Learning: Dr. Emma Sokell
- Graduate Studies Director: Prof. Peter Duffy
- Lecturer: Dr. James Rice
- Office Manager: Ms. Marian Hanson
- Chief Technical Officer: Mr. David Cooney
- Senior Technical Officer: Mr. Thomas O'Reilly
- Postgraduate Student Representative: Daniel O'Brien
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The draft Quality Improvement Plan was discussed at a School Committee meeting on June 14th, 2011 and reviewed in light of comments received. It was discussed with the Acting College Principal of Engineering, Mathematical and Physical Sciences, Prof. Chen-Ching Liu, on 23rd June and submitted to the Quality Office on July 1st.

2. Recommendations for Improvements – Follow-Up Action Taken and/or Planned

CATEGORY 1: Recommendations concerning academic, organisational and other matters which are entirely under the control of the unit

- **Category 1(a)**

Recommendations already implemented

1. Recommendation: (2.13) There is a need to clarify the organisational structure of the School and for more formal and regular meetings of the School Management group.

Action taken: The School agreed in late 2010 to a new sub-committee structure to streamline decision-making and to provide greater involvement of more stakeholders in discussions and recommendations to the School. The decision-making body is the School Committee, consisting of all academic staff, postgraduate and post-doc representatives and the research and innovation officer. This committee usually meets every 6-8 weeks, with formal agenda and minutes recorded. The decisions of this committee are implemented by the Head of School, or sub-committee chair as appropriate.

2. Recommendation: (2.14) It may be useful to include postgraduate and postdoctoral (and possibly undergraduate) representatives at School meetings.

Action taken: Postgraduate and postdoctoral representatives now sit on the School committee. Undergraduate representatives sit on the teaching team sub-committees.

3. Recommendation: (2.17) It could be helpful to establish an 'early career group' of academic staff that would have real input into the running and planning of the School.

Action taken: An early career development group was established in late 2010. A budget was earmarked for the group members to allow them to invite speakers, take courses, participate in conferences and develop networks.

4. Recommendation: (2.19) There is a need for better integration of postgraduate students (including taught Masters students) and postdoctoral students into the life of the School, for example, by way of weekly brown bag lunches with discussion of work-in-progress, research colloquia or social events; it might be helpful to establish a committee of postgraduates/postdoctoral students, possibly including one or two academic staff, to plan such academic and social events in the School.

(7.14) The School should form a postgraduate student committee; one of its functions could be to organise regular research seminars that cut across research groups.

Action taken: A graduate studies committee has been set up, involving academics, postgraduates and administrative staff. It serves as a communication/ideas forum between those involved in different aspects of graduate studies such as research and taught graduate students, administrative matters, marketing, coordination of multi-institute

graduate programmes (e.g. DRHEA and DGPP), graduate student seminar series, informal event organisation etc. A programme of social events, organised by the postgraduate students, has been financially supported by the School. PhD students present their research to the School after their first 12-18 months of work as part of the transfer process, as well as their formal seminar as part of the *viva voce* exam at the end of the PhD.

5. Recommendation: (3.13) There is a need to develop appropriate reading space for undergraduate students for 1st and 2nd stage students along the lines of that currently available to students at a more advanced stage.
(8.11) The feasibility of providing a study-room facility for 1st & 2nd year students should be investigated.

Action taken: An open learning space, Room 232, was refurbished in 2011 and has been extensively used by physics students for study and group work since it was opened. In the future it will only be available at restricted times, due to the centralised timetabling of the room. However, out of teaching hours, it will continue to provide an excellent study environment. Café style tables and chairs have been placed on the 1st and 2nd floor lobby areas in physics, which are also being used extensively by physics students. In the redeveloped Science Centre there will be many reading spaces for all students. However, we believe it is essential for physics students to have an area in which to work together and will try to develop new ideas to allow this to happen for 1st and 2nd years.

6. Recommendation: (4.7) It is important that physics teaching is executed by physicists who have a proper research background.

Action taken: Teaching of 'PHYC' modules is always conducted by physicists. The School will continue to maintain its commitment to deliver physics to all undergraduate programmes that require it and to provide post-graduate courses appropriate to the School's expertise and resource capacity. All members of the academic staff are research active and the School is committed to maintaining this. It is preferred that specific topics at advanced undergraduate or taught graduate level and/or in specialist undergraduate topics be taught by a physicist with expertise in that particular research area. However, this may not always be possible due to lack of appropriate staff.

7. Recommendation: (4.9) The possibility of moving away from individual experiments in final year towards more advanced research projects (possibly hosted by the research groups in the School) should be considered.

Action taken: The School has already introduced an element of research project into the final year laboratory, which meets with the requirements for project work of the Institute of Physics accreditation. One quarter of the laboratory is generally a short research experience. All staff members are invited to provide projects. The model was piloted for the Physics with Astronomy and Space Science students in the academic session 2009/10 and made available to all non-Theoretical Physics students in 2010/11. Theoretical Physics students already do an equivalent (in terms of credit) theoretical physics project. All students are required to give an oral and written presentation of their project work. This approach gives students a chance to experience research-based project work whilst ensuring that difficulties associated with uneven project experiences are not overly significant.

8. Recommendation: (4.10) There should be increased outreach to schools to inform them about new directions in the UCD School of Physics, especially in the emerging area of biophysics (both experimental and simulation fields) and in molecular simulations for materials, energy and nano-bio sciences.

(4.11) It should be emphasised that UCD has significant strengths in the fields of particle physics at the Large Hadron Collider at CERN and in astrophysics on the hot topic of gamma ray bursts.

(9.10) The Review Group recommends that current student recruitment efforts be maintained and strengthened and that all staff be encouraged to contribute to this important effort.

Action taken: Local schools were targeted in April 2010, with postgraduate students and staff preparing high quality presentations on the above and other modern physics topics, to present to 5th and 6th years. About 9 local schools were visited and a further 3 outside the Dublin area. In addition, many staff voluntarily go to schools with whom they have a connection, to make presentations. Due to the change in the Science Programme for 2011, the emphasis in 2010/11 has been on explaining the new structure to prospective students. The physics school visits programme will be continued in 2011/12. The CERN and astrophysics elements of the School's activities will continue to be highlighted. Outreach activity by staff is considered as part of the workload allocation model when assigning duties. Dublin's City of Science status in 2012 will be used to highlight the School's research profile among the wider public.

9. Recommendation: (6.15) The enhanced coordination of combined research activities across the Dublin Universities should be seriously examined in some areas.

Action taken: The recent funding of the PRTLI V Dublin Physics Graduate Programme (DGPP) will promote research co-operation and co-ordination between TCD and UCD. It will be based on a bottom-up approach driven by interactions between academics who will be organising joint high level courses, in topics of mutual interest. The DGPP already envisages enabling access to equipment/facilities across institutions. Such close co-operation will naturally lead to the establishment of collaboration and co-ordinated research activity driven by staff and student interactions. Moreover the DGPP provides a framework that can be extended to involve the other Dublin Universities and DIT, who are already co-operating formally through the Dublin Region Higher Education Alliance (DRHEA), of which the School is a leading participant.

One of the strengths highlighted in the DGPP review was the low level of overlap between research activities and expertise in TCD and UCD, so that the combination of these complementary areas provides the very comprehensive range of activities one would associate with a major leading Physics School. Given this observation, it is notable that some collaboration already exists amongst a number of the groups with overlapping interests e.g. Atomic, Molecular and Plasma Physics with TCD and DCU; Astrophysics with DIAS; Spintronics with TCD etc. Because of the strong focus in DGPP on teaching in areas relevant to the research of more recently appointed staff, it is anticipated that the level of co-operation will grow significantly in the future.

10. Recommendation: (7.7) Due to the combination of omnibus and denominated entry, there are considerable difficulties in ensuring the quality of undergraduate intake and maintaining the competitiveness of the physics degree in the Irish context. The Review Group emphasises the need for

ongoing efforts to ensure key areas of interest are prominent in the prospectus documents.

Action Taken: The School will continue to review its outreach strategy and ensure that frontier work being carried out in the School is highlighted in its own literature and website, in the Science Programme's and UCD's promotional literature and in the Institute of Physics 'Physics On-Course' brochure. In this context, areas where UCD Physics has nationally unique expertise are especially important. It should be emphasised that whilst the School recognises the importance of outreach activities its resources are limited and it should ensure that it benefits as much as possible from central resources, such as the Science Programme's Education & Outreach Manager.

11. Recommendation: (7.12) More emphasis should be placed on internationalisation, in particular, on sending undergraduate, postgraduate and postdoctoral students, as well as staff, abroad and on attracting doctoral and postdoctoral students from abroad.

(9.11) The School should continue to nurture and expand its international linkages, which have proven to be very valuable to date.

Action taken: There is already a significant international flavour to the School's staff, post-doc and graduate student profile. Recruitment visits to China for taught MSc programmes have been undertaken in the last 2 years, along with advertisements in international magazines and journals. Four of the current 2nd year undergraduate physics students will be spending a year or semester abroad in the coming year. All staff publish in international peer-reviewed journals, have international collaborators, regularly give talks (and organise) international conferences, are awarded time on large-scale facilities and many gain funding from international organisations. Many graduate students spend time abroad as part of their research experience during the PhD. To further strengthen this on-going activity, a staff member has been given responsibility for internationalisation.

12. Recommendation: (7.13) The School should establish a practice of regularly inviting distinguished speakers and young researchers from outside the School for invited speaker seminars.

Action taken: The seminar series was reinvigorated in 2010-11 with further development foreseen in 2011-12. Funding for speakers was allocated from the research overhead funding. Strengthening of links with the Institute of Physics will also be helpful in bringing in high-profile speakers.

13. Recommendation: (7.15) The School should systematically keep track of graduates and alumni that could help with donations and funding for key initiatives.

Action taken: The School already has a reasonably up-to-date listing of alumni and will ensure this is made available within the School in an easily useable format as part of the fund-raising strategy which we are beginning to develop.

- **Category 1(b)**

Recommendations to be implemented within one year

1. Recommendation: (2.15) It may be useful to include Technical Officers at School meetings.

Action planned: This item will be placed on the agenda of the School committee with a view to implementation, if approved, by September 2011.

2. Recommendation: (2.18) It would be helpful to have a formal policy of research leave in the School and to establish a rota for this.

Action planned: Due to the current freeze on recruitment along with additional graduate teaching commitments arising from the DGPP, there may not be sufficient flexibility in teaching allocations to ensure that any formal rota for extended research leave (3-12 months) could be implemented at this time. However, this will be placed on the agenda of the School committee for discussion. A School policy on short (e.g. 1-2 month) research breaks will be developed to allow concentrated periods of time in order to complete a piece of research work. Such breaks should not interfere with the on-going business of the School and hence a workable and fair policy will be developed.

3. Recommendation: (3.15) There is a need to introduce more informal contacts not just among students but also among the academic staff, e.g. by organising a monthly brown bag lunch etc.

Action planned: Staff are highly time-committed during the semester and out of semester many spend time at international facilities and participating in conferences. In addition, many academics are linked to research institutes or clusters within UCD that have their own networking activities. It will be difficult to get buy-in from staff to commit limited resources to such an activity at School level. The best way to go about implementing such a recommendation will be considered by the School committee.

4. Recommendation: (4.8) There should be better coordination between teachers and modules to avoid an unintentional extremely high workload for students at certain times (i.e. avoid assignments on a number of modules in the same week).

Action planned: The School will continue to utilise the teaching team structures to try and minimize "pile-up" of assignments. This should work well for most 3rd and 4th year students in the present academic structure. Although it is harder to coordinate assignments for students in earlier stages, the School will continue to engage with first year module coordinators in other Schools to try to minimise this problem.

5. Recommendation: (4.12) The option of 'theoretical physics' should be extended to include more computational physics and it should be renamed 'theoretical and computational physics'.

(7.10) There is a need for on-going review of the physics curricula in light of new staff expertise.

Action planned: The School will consider the naming of the theoretical physics degree. The science programme will be changing, quite dramatically, for students entering in 2011 and in line with this change the School is presently reviewing all of its science programme modules. The theoretical physics programme is being considered as part of this review. It is envisaged that the expertise of new staff members, including computational simulation, will be reflected in the new programme.

6. Recommendation: (5.4) Restructuring of mathematics modules is required to better fit the needs of physicists.
(7.11) The School should seriously consider developing new maths modules designed for physics students.

Action planned: This issue has received a large amount of attention as part of the planning for the restructured Science Programme (see 4.12). For the 2011/12 session the vast majority of physics students will be expected to take "Calculus in the Physical Sciences" and "Linear Algebra in the Physical Sciences", early in their Programme. These modules are being designed around the needs of physics students. In addition, the new curriculum is being designed around all physics students taking 4 additional mathematics modules, (multivariable-calculus, vector calculus, differential equation and computational science) that will cover the maths required for physics modules and ensure that all physics students have the appropriate mathematical background before they start year 3.

7. Recommendation: (5.5) Consideration should be given to the introduction of a 6-month industry placement as part of the undergraduate physics programme.

Action planned: Whilst it is hard to see how a 6 month placement would fit into our physics programme without compromising the core physics training, the School will consider the feasibility of incorporating a less prolonged industry experience into the physics programme. This year the School introduced a 5 credit elective module in which 3rd year physics students collaborated with artists from the National College of Art and Design and perhaps this model would also work for an industrial placement. The experience in institutions that offer industry placements as part of the undergraduate programme is that additional resources are required to deal with the companies and to monitor the students' progress. Such resources are unlikely to be forthcoming in the near future.

8. Recommendation: (6.14) A more comprehensive IT support service should be configured, possibly on a cross-school basis. Furthermore, there is a lack of clarity as to who provides computational resources and IT support for the ACAM group that needs to be resolved.

(8.10) The Review Group calls for a more comprehensive configuration of IT support service, possibly on a cross-School basis and in active collaboration with UCD IT Services. The IT support requirements of the ACAM group and others physics researchers located in the Engineering & Materials Science Centre should be considered as part of any revision to current arrangements.

Action planned: The School's IT committee consists of members of physics, ACAM, CASL and IT services. This committee will review current arrangements for provision of `normal' IT, as well as high-performance computing, support and report its recommendations to the School committee for actioning.

- **Category 1(c)**

  Recommendations to be implemented within five years

  None

- **Category 1(d)**

  Recommendations which will not be implemented

  1. Recommendation: (5.6) There is a need to publicise the taught Masters programme in nano-bio sciences among biology students by emphasizing the traditional role of physics in developing new instruments (e.g. in imaging biological structures) that will be increasingly important in biology in the future.

  Reason for not implementing: With the current nanobio science curriculum, biology students would not have the maths and physics background required for certain modules. Two modules (to be reduced to 1) of the nanobio science programme are available to students taking the MSc in 'Imaging', run by SBES. These students have minimal preparation in physics/maths, which makes the modules very challenging for them.

CATEGORY 2: Recommendations concerning shortcomings in services, procedures and facilities which are outside the control of the unit

- **Category 2(a)**

  Recommendations already implemented

  1. Recommendation: (2.22) The School is currently experiencing major difficulties with e-procurement (also noted in Section 8 below). This problem is resulting in a significant loss of administrative staff time and needs to be resolved as a matter of urgency. E-procurement was designed to facilitate bulk central purchasing and reduce time required manually to chase up invoices/payments. If used properly this should be the case.

  Action taken: The School is making every effort to resolve the problems being experienced by both sides i.e. School users and the Accounts department. Additional training has been provided to the School by eProcurement staff. A staff member has agreed to take on responsibility for purchasing of laboratory-related items for the School, relieving the pressure somewhat from other staff, who are infrequent users and who find the system extremely frustrating. New arrangements are in place with frontline staff to liaise regularly with the Accounts department to ensure invoices don't remain unpaid beyond the maximum 30 days.

  2. Recommendation: (3.10) There is an urgent need to clarify the status of the Research and Innovation Officer and to issue an appropriate contract.

  Action taken: This role was 'sized' externally in 2010 and the recommendation of the external group was adopted by UCD HR. The staff member is now on an appropriate scale.

- **Category 2(b)**

Recommendations to be implemented within one year

1. Recommendation: (2.20) A small number of academic staff expressed dissatisfaction with teaching and/or administrative workloads. In the case of the administrative workload, the main problem seems to be the increased amount of bureaucracy at College and University level. This increased amount of bureaucracy has resulted in a worrying level of stress and exhaustion for some members of staff. The University should work towards reducing bureaucracy, in particular, towards avoiding duplication of requests for information or policy documents. It should also explore the possibility of reducing the number of College committees that School representatives are obliged to attend on a regular basis.

Action Planned: The School will make every effort to raise this issue with the Senior Management of the University. The restructuring of the Colleges of EMPS and Life Sciences into a College of Engineering & Architecture and a College of Science should remove the added layer of administration which was caused by the BSc programme operating across two colleges.

2. Recommendation: (2.21) The School has been successful in reducing its financial deficit but the overheads costs to the School for central services have risen in recent years. Reasons for the rises have not always been made clear to the School. This is demoralising and does not help to motivate further efforts to reduce the deficit. The Review Group is mindful of the difficult financial circumstances in which the University finds itself but recommends that there should be no further increase in central costs without convincing justification and that every effort should be made to communicate with the School about the methods used to allocate resources so that it can understand what is being provided in return for its contribution.

Action Planned: The School will make every effort to raise this issue with the new College of Science principal and financial manager.

3. Recommendation: (3.11) There is a need to maintain the traditionally excellent electronic and mechanical workshop, if necessary through cooperative arrangements with other Schools, e.g. Engineering and Chemistry. Overhead funds from research grants should be contributing to these workshops as they are a key core resource for the Physics research and teaching programmes.

Action Planned: Due to now critical levels of understaffing on the technical side, and the low likelihood of new recruitment due to the University's financial position, the School will develop further links with other Schools and Institutes in order to share technical resources, in so far as this is feasible and in line with accepted work practices. The allocation of research overhead funds back to the School is extremely small and it would not be feasible to hire someone from this fund as it is currently disbursed.

4. Recommendation: (7.8) The Review Group also emphasises the need for a greater proportion of research overhead support to come back to the School in order to underpin the basic infrastructure. This is crucial from the point of view of staff morale, since it shows that success in achieving research funding is good for the whole School.

Action Planned: The School will raise this issue with the new College of Science principal and financial manager.

5. Recommendation: (8.12) A Financial Analysis / Business Planning Tool should be made available to the Head of School to enable a more accurate quantification of the impact of future developments in student enrolment, research activity, space usage etc.; this would also facilitate sensitivity analysis.

Action Planned: The School will raise this issue with the new College of Science principal and financial manager.

- **Category 2(c)**

Recommendations to be implemented within five years

None

- **Category 2(d)**

Recommendations which will not be implemented

1. Recommendation: (6.14) The School should try to coordinate its grant applications to reduce the bureaucratic load and enhance success rates.

Reason for not implementing: The bureaucratic load is largely outside the control of the School, as it involves a number of different offices both within and outside UCD. It is the responsibility of individual staff to prioritise their own applications for funding, in response to relevant international and national calls.

CATEGORY 3: Recommendations concerning inadequate staffing, and/or facilities which require recurrent or capital funding

- **Category 3(a)**

Recommendations already implemented

1. Recommendation: (2.16) The Head of School's heavy managerial and administrative load should be alleviated, for example by enabling a teaching buy-out, as happens with many leadership posts. Filling the currently vacant administrative post in the School office would certainly also help.

Action taken: Additional teaching resources were made available for the first time in 2010/11. Filling the currently vacant administrative post is not foreseen at this time due to the hiring embargo.

- **Category 3(b)**

Recommendations to be implemented within one year

1. Recommendation: (3.12) There is an urgent need to replace the currently vacant administrative post.

Action planned: It was not possible to convince the EMPS College finance manager to bring the case for this position forward to the Budget Review Committee in recent months. The need for this position will continue to be articulated within the College of Science.

2. Recommendation: (6.16) There is a need to ensure maintenance of research capability in radiation physics in the future, given the pending retirement in this area

Action planned: The case for prioritising the strengthening of capability in the area of medical/radiation physics, now that there is only one staff member who is active in the field, will be discussed by the School. If agreed as a strategic priority, the case for a staff position will be progressed to the College Principal.

3. Recommendation: (7.9) The recent significant improvements to service teaching (e.g. the introduction of physics for medical students) require considerable time commitment from staff and have been inadequately funded. Funding for this should be increased.

Action planned: The School is highly committed to ensuring that the most appropriate physics curriculum is delivered to each group of students it teaches. It works with the relevant programme deans and heads of teaching and learning to ensure stakeholder needs are met, within resources. In view of the new structures in 1st Agriculture and 1st Science, significant School resources are being devoted to developing new enquiry-based physics practicals, which could be used by all programmes which require early physics skills training. In addition, new on-line materials are being proposed for 1st Engineering, which would considerably enhance the student engagement and problem-solving, but at a cost. For funding for these activities to be increased, the School budget would have to be increased, which does not look likely at the moment.

- **Category 3(c)**

  Recommendations to be implemented within five years

  None

- **Category 3(d)**

  Recommendations which will not be implemented

  None

3. Prioritised Resource Requirements

This section should only contain a list, prioritised by the Quality Improvement Committee, of recommendations outlined in the Review Group Report, which require additional resources. The planned action to address each recommendation with an estimate of the cost involved should also be included:

1. **Filling of the vacant administrative post (3.12):** Estimated cost to the School of a full-time executive assistant: €37,000.

2. **Additional funding for service teaching (7.9):** Implementation of enquiry-led experiments in physics practicals, including provision of extra demonstrators: €15,000.

On-line materials for 1st Engineering: €4,000.

3. **New lecturer in medical/radiation physics (6.16):** €80,000.
4. **Provision of 1st and 2nd year study space:** ~ €7,000.

Note: The Quality Improvement Plan should be used to inform School/Support Unit and College level academic, support service and resource planning activities.