NUI MAYNOOTH

Ollscoil na hÉireann Má Nuad

Quality Review of the

Department of Computer Science

March 2009

Peer Review Report

Peer Review Group:

External reviewers: **Professor David Bustard,**
                          University of Ulster at Coleraine,
                          Northern Ireland;
                          Professor Robert Pooley, Heriot-Watt University,
                          Scotland.

External stakeholder: **Mr Liam Cronin, Microsoft Ireland;**

Internal reviewers: **Dr Bernard Mahon, Dean of Faculty of Science &**
                          Engineering, NUIM;
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Summary

This document summarises the results of a Quality Review of the Department of Computer Science at Maynooth, held in March 2009. The Review, carried out by an appointed Peer Review Group, was based on the analysis a Self-Assessment Report produced by the Department, combined with the results of subsequent discussions with relevant stakeholders within the University. These included the President, staff of the Department, and a representative set of students at both undergraduate and postgraduate level.

The Peer Review Group had a very positive experience overall and was pleased to identify a number of significant strengths within the Department. In particular, the students who were consulted emphasised the friendliness, approachability and accessibility of staff; the high standard of computing laboratories; and the general appeal of the campus. The Review Group also highlighted the benefit of student engagement and resulting success in computing competitions, and the contribution made by the Department to the major corporate achievement of the Sunday Times Irish University of the Year Award for 2008.

This report provides a set of recommendations to assist the Department in its production of an improvement plan. These vary in scale from broad recommendations on strategy to detailed suggestions for change identified by individual students. Some recommendations can be tackled by the Department directly while others will involve discussion and negotiation with other bodies.

The Review Group identified the Department's main challenge as its low Student Staff Ratio, which is less than 10:1; this is significantly lower that the Faculty average of over 15:1, the University average of over 20:1, and is less than half of what it had been when the Department was established in its current form and location. The consequential gap in income is making it progressively more difficult for the Department to retain its existing facilities and staff, and inhibiting its plans for the future.

It is commendable that the Department has risen to this challenge by introducing a number of innovative cross-disciplinary programmes, and it is encouraging to note that application numbers have increased for the 2009 intake. Nevertheless, it seems important for the Department to give more attention to this issue, adopting a stronger business ethos and taking more direct responsibility for marketing. In that respect, the Department has the advantage of a strong local market and is developing skills for which there remains a relatively strong business demand.

The Review covered *Teaching and Learning*, *Research and Scholarship*, and *Service to other Communities*. In practice, most attention has been given to Teaching and Learning as this is currently the area of greatest concern. Research and Scholarship has continued to develop steadily in the last period, with an emphasis on increased collaboration, journal publication and greater formality in PhD supervision. Overall success is confirmed by Maynooth having the highest recorded level of research income per member of staff in 2008, as measured across all universities in Ireland.

In developing its improvement plans, the Department is encouraged to make explicit all significant threats to its effective operation and determine ways of reducing such risks, where possible.

Introduction

The Computer Science Department was founded in 1987. Following the formation of the National University of Ireland Maynooth (NUIM), the Department expanded rapidly over a three year period, peaking at 21 academics in 2000. That year, the Callan Building extension was opened to bring the Department under one roof, and also make available two additional large undergraduate teaching laboratories, a hardware laboratory and research facilities. It currently has 17 permanent academic staff (2 professors, 4 senior lecturers and 11 lecturers), with 3 contract lecturers to cover secondment and other absence among the permanent staff. The Department is supported by 4 Technicians, an Industrial Placement Officer (shared with other departments), a Departmental Administrator and four Executive Assistants (job-sharing two full-time positions).

Teaching and Learning

Computer Science was first available in Maynooth as a single honours subject in 1995, as the third and fourth years of a Science degree. Following the formation of NUIM in 1997, a full four-year dedicated undergraduate degree in Computer Science and Software Engineering (CSSE) was introduced. Undergraduate student numbers peaked in 2000, with 98 entering CSSE that year.

Postgraduate conversion courses, based on the undergraduate curriculum, for graduates with non-computing degrees, were introduced in 1990 (HDipIT–one year) and 1991 (MCompSci–two years including dissertation). The availability of targeted funding for IT skills allowed a postgraduate degree in Software Engineering to be introduced in 1996; this was taught in two-week modular blocks and included an industrial placement. In 2000, 130 students were recruited to the HDipIT. Recently, postgraduate degrees have been revised to allow for specialised streams in the re-titled MSc in Computer Science but these have yet to run due to low demand. The Master of Computer Science degree has also been suspended.

Since the peak in 2000, and in common with many Computer Science Departments around the world, and also like Science and Engineering Departments in NUIM, there has been a decline in demand for programmes in Computing. So, for example, in contrast to the 98 and 130 entry figures for CSSE and HDipIT students in 2000, 19 entered CSSE in 2008, and 7 were recruited to the HDipIT. Entry requirements have been lowered in an attempt to improve recruitment but with apparently little effect. More significantly, the Department has introduced new programmes in collaboration with other Departments: in Arts (2002), Finance and Venture Management (2003), Music Technology (2005) and Multimedia (2007). Curricula have also been revised to emphasise core skills and a common first year has been introduced to allow transfer in and out of CSSE in second year. It is now possible to combine Computer Science with most other subjects available in Arts and Science on campus. This has brought class sizes in first and second year close to their historic maxima but now involves teaching a group of students that is much more diverse, requiring additional support. There has also been some consolidation and rationalisation of teaching to eliminate duplication across programmes.

Undergraduate and Postgraduate Degrees

The following degrees are offered by the Department.

Undergraduate programmes with a major component of Computer Science:

- BSc Computer Science and Software Engineering (CSSE)
- BSc (Single Honours) in Computer Science
- BSc (Double Honours) in Computer Science plus one other science subject
- BSc Finance and Venture Management
- BSc Multimedia
- BA (Double Honours) in Computer Science plus one other Arts/Social Science subject
- BA Music Technology
- BA Multimedia
- BSc Applied Computer Science (one-year top-up programme)

Undergraduate programmes including modules taught by Computer Science:

- BSc Biological and Biomedical Sciences
- BSc Biotechnology
- BSc Chemistry with Pharmaceutical Chemistry
- BSc Genetics and Bioinformatics
- BSc Physics with Astrophysics
- BA Media Studies
- BA Anthropology Single Honours
- BA Finance (Major-Minor)
- BA Mathematics
- BA Psychology

Postgraduate degrees

- MSc in Computer Science (Software Engineering)
- MSc in Computer Science (Web Development) [not currently running]
- MSc in Computer Science (Security) [not currently running]
- MSc in Computer Science (Signal Processing & Robotics) [not currently running]
- MSc in Geocomputation (to start 2009)
- MSc Degree (by research)
- PhD Degree (by research)

Postgraduate diplomas

- Higher Diploma in Information Technology
- Postgraduate Diploma in Science (Software Engineering)
- Higher Diploma in Science (Computer Science) (to start 2009)
- Postgraduate Diploma in Science (Geocomputation) (to start 2009)

Research and Scholarship

The Department has taken an interdisciplinary approach to research, which now means that it collaborates extensively with several other subject areas and associated research centres.

These include the *National Centre for Geocomputation*, *An Foras Feasa*, the *Hamilton Institute* and the *Wireless and Microelectronics Institute*.

The Department has six main active research groups:

- Computer Vision and Imaging Laboratory
- Computational Cognitive Modelling
- Principles of Programming
- Computer Security and Cryptography Group
- Digital Holography
- Geocomputation

As a result of this collaboration, research publications from the Department cover a wide range of journals and conferences. Research output has increased substantially in the last ten years but levelled off in the last five years. To some extent this reflects the drop in staff numbers but there has also been a greater emphasis on journal publications, with less conference attendance. There has also been a drop in postgraduate numbers, which is considered to be a contributing factor.

Research funding in the Department has been at an impressively high level over the past two years, both in terms of the number of awards and the amount involved, though in many cases this is shared with other collaborative groups.

From 2007, the Department has also become much more involved in collaborative work with industry, across a range of companies and in many different application areas.

The Department currently has 37 research students supervised by 12 staff. This seems like a healthy recruitment level but the Department has ambitions to increase this number. Since the last review a comprehensive support structure for staff and students has been introduced, including the appointment of an academic postgraduate coordinator, the establishment of a review committee and the introduction of annual reports.

Review

The Quality Review of the Department of Computer Science was undertaken by an appointed Peer Review Group. Its membership was as follows:

- *Two Senior Members of the University*: Dr Bernard Mahon (Dean of Faculty of Science & Engineering); Mr Cathal McCauley (Librarian)
- *Two International Peers*: Professor David Bustard (University of Ulster, Coleraine) and Professor Robert Pooley (Heriot-Watt University)
- *An External Stakeholder*: Mr Liam Cronin (Microsoft Ireland)

The Review was based on a combination of information gleaned from a Self-Assessment Report provided by the Department and information gathered from a series of meetings with relevant stakeholders in the Department and wider University. The schedule of meetings was developed by the Quality Promotion Office. They started at 1.00pm on 11 March and were completed at noon on 13 March, with initial conclusions presented that afternoon to the Department and the Quality Promotion Office.

The information provided in this section was largely covered in those conclusions though, as indicated at the presentation, a few additional points have been identified as a

result of working through interview notes and in preparing this report. As in the presentation, this aspect of the report has been divided into five sub-sections covering:

- Assumptions made in approaching the Review
- Strengths identified in the work of the Department
- The identification of problems and threats that are considered to be of high priority
- Other recommendations for change arising from the Review
- Comments on the review process itself

Assumptions

In producing this report it was assumed that:

- The main purpose of the Review was to help the Department of Computer Science create a vision, strategy and action plan for improvement, based on recommendations in the report, integrated with its own development plans, and taking account of the constraints and objectives set by the University
- Common quality control mechanisms in the UK, such as those implemented by the Quality Control Agency (QAA), the Research Assessment Exercise (RAE), and accreditation visits from the British Computer Society (BCS) or other professional body, are a reasonable indication of how practices in Ireland are likely to develop, implying that comparison with these UK approaches can provide useful ideas for development within the Department
- The running of any academic department, in Ireland or the UK, is likely to be approached more and more as the management of a 'business', with all staff contributing to its success and practices adopted, where appropriate, from industry. Typical practices include:
  - Emphasis on making a profit (or at least avoiding a loss)
  - The setting of measurable targets to focus activity and gauge achievement
  - The need to innovate continually, to stay ahead of competitors or at least avoid falling behind them
  - The need to take tough decisions in terms of where to focus limited resources and avoid propping up unprofitable activity
  - The need to provide good 'products and services' and ensure that they are marketed appropriately

Strengths

A number of significant strengths were identified through the Review:

- The Sunday Times 2008 University of the Year Award to Maynooth is a substantial achievement and the Department is to be commended on its contribution to this success. League tables of this type are of growing importance in student recruitment, evidenced by the awareness that students had of the award. The three main areas of contribution from the Department seem to be in *research* (average research income per member of staff), *employment* (almost full employability of graduates) and *student/staff ratio* (a low figure being beneficial to student teaching, though also a problem for Departmental finances, as discussed later).
- The Department has a strong local student market, with about 80% of those within travelling distance of the University making Maynooth their first choice. The

advantage was encapsulated by one student who said that Maynooth was "...close to home and near to Dublin".

- For many students, the relatively small size of the University is very attractive. In particular, its size reduces the feeling of being overwhelmed or 'lost' on a first visit and helps those on campus get to know each other more easily.

- Students consider most Department staff to be very friendly, approachable and accessible.

- Students praise the standard of the computing laboratories and associated facilities, often in relation to those seen in other universities.

- The introduction of cross disciplinary programmes in innovative areas has attracted very well qualified candidates, especially in Music Technology. It is recognised, however, that such relationships are difficult to establish and maintain, and that there are often challenges in finding appropriate placements for such students and securing funding for specialist facilities needed for teaching.

- Recent success in competitions such as the Microsoft Imagine Cup has been substantial, enhancing the external profile of the Department and increasing motivation and interest among students. Such achievements also reflect well on the dedication and enthusiasm of the staff supporting these initiatives.

- The attitude and energy of the contract lecturers seemed particularly impressive, making them very well suited to the teaching of first-year classes, though, with large class sizes, there was some concern about the time they then had available to develop a research profile.

- There has been significant progress in the management of research students since the last Review, improving the chances of student success within four years.

- Staff involvement in 'enterprise', covering commercialisation, industrialisation and patents seems to have increased substantially in the last two years. Such links can obviously bring direct benefit to the staff concerned but also help inform teaching within the Department, and build collaborative links that help secure research funding.

- The management of computing placements seems excellent, resulting in virtually all students being found suitable employment; the strong proactive approach taken to identify new placement opportunities is particularly commendable.

- The administrative support provided in the Department is likewise excellent, providing a framework for a wide range of key activities, and contributing to what appears to be very effective day-to-day operations.

- It is a significant benefit to have technical staff who can cover each other's responsibilities, and provide direct teaching support, in addition to technical expertise.

Other more specific items of commendation include:
- The use of Lego Mindstorms with Java to introduce programming, as a way of motivating interest.
- The use of group work in first year, though recognising that this type of work often needs a 'champion' to ensure its success.
- The use of Moodle to support discussion groups.
- The introduction of innovative Chinese exchange programmes, while acknowledging that numbers taking up such opportunities are likely to remain small.

- The use of a feedback system that allows examination performance to be discussed with students to help them improve their performance.

Problems and Threats

Student Recruitment Issue

The Department, in common with computing departments around the world has experienced a significant drop in student numbers over the past 10 years. This is an issue that has been tackled in recent years but remains by far the most significant challenge for the immediate future. It is very encouraging that application numbers have increased for 2009 entry but a greater focus on this area may be needed to achieve the necessary levels of recruitment. In tackling this challenge, the Department is encouraged to:
- Develop an explicit Student/Staff ratio target to be clear about the extent of the challenge.
- Take greater responsibility for the marketing of existing courses, including the development of stronger relationships with local schools.
- Explore wider markets both within Ireland and internationally, in partnership with the University.
- Continue to explore opportunities for collaboration within the University, though treating each initiative as an 'experiment' to be monitored carefully in case no net benefit accrues.
- Continue to examine retraining opportunities arising from the current economic situation.
- Continue to monitor and provide pastoral care for current students to ensure that those who start a course complete it successfully.

Other threats

It seems desirable to develop a list of threats/risks associated with the operation of the Department, together with a strategy for risk reduction and the creation of contingency plans to handle problems that do arise. For example, some current risks include:
- Until student number increase it will be difficult to replace staff who leave. What would be the implications of losing some of the existing staff?
- In particular, there is strong dependence on a few specific personnel, particularly in relation to the management of placement and departmental administration.
- Finding sufficient funds to replace large laboratories, within a typical cycle of four years is becoming difficult; delay in replacement increases the risk.
- It is difficult to maintain ownership of teaching and staff space while student numbers are low. It may be helpful to decide on a minimum lab requirement, taking account of extensive laptop ownership among students. Responsibilities of technical staff would also need to evolve, though that doesn't appear to be an obstacle.
- Changes to National policies on fee support could affect the number attending university and/or their choice of institution, depending on the level of fee set. This is probably an institution-wide issue though each subject area will need to carry out its own assessment.

- Now that Maynooth has been named University of the Year and jumped to fourth place in the national league table, there is a risk of falling back! Again, this is an institutional concern but one to which each department should contribute.

Other Recommendations

The following recommendations are offered for other areas:

- The self-assessment document refers back to Reviews in 2000 and 2005, showing tables of recommendations in each case. It would be easier to have just one one table current at any time, so in developing a new strategic plan from the current Review, any outstanding actions from earlier Reviews should be carried forward into a single newly developed table for 2009.
- In the currently changing economic climate, it seems prudent to review strategies and action plans more frequently than has been the case in earlier years. This is particularly true in Computer Science, because of the need to increase student numbers and/or manage a controlled reduction in Departmental resources. A thorough annual review, performed internally, seems desirable for the immediate future.
- The University and the Department seem to lack a development policy for new staff. In particular, this is a disadvantage for fixed term contract staff, who have difficulty establishing their careers. Mentoring, training and managed early years should be considered.
- The current research strategy in the Department seems to depend on individual responses to opportunities, rather than being part of a collective effort. A more explicitly managed approach to research should be considered, given the increasingly difficult environment now faced. The Department could also develop a more conscious self promotion approach, reflected in the information presented through its website.
- The strategy of assuming that all academic staff are 'research active' may not produce the optimum result from the existing staff pool. This, however, is probably another issue that needs to be addressed at University level.
- Improved postgraduate research student management is increasing the chances of PhD completion within four years. However, some seem likely to overrun this target, which elsewhere would be treated as 'failure' in completion statistics. Reducing the completion target to three and half years may be beneficial for the student, supervisors, Department and University.
- The self-assessment report goes into detail on the paper production rate for each member of staff. The other two key research performance indicators are research funding and research student completions. These would also benefit from a similarly detailed analysis and help produce a more rounded picture for each person involved.
- The information on research income to the Department is unclear. It would be better if the relative income from collaborative projects were shown in the income table as well as the total project funding.
- Consideration should be given to a more flexible way of managing ownership and use of laboratory and other space. This is likely to involve both central and departmental mechanisms.

- The means of resourcing the innovative degree programmes run with Music (specialist equipment) and Media (specialist staff) to ensure continued leadership in these areas needs to be reviewed routinely For example, the University should ensure that cross department initiatives have a clear way of managing resourcing issues. In particular, the Music Department has a current difficulty in upgrading its music technology laboratory for the shared programme with Computer Science.
- The relatively low percentage of female students and staff in the Department should be reviewed to ensure that all reasonable steps to address the imbalance have been considered.

A number of specific issues arose in discussion with students:

- Many undergraduates were unhappy with the local transport service, which seems important as the number of local students has grown rapidly.
- Parking can be very difficult on campus, especially on a Monday. Again, with the growing number of local students, this problem is likely to become worse.
- The process for reimbursing postgraduate expenses for attendance at conferences is very slow, causing hardship in some cases.
- There is some concern among past graduates that the BSc Computer Science and Software Engineering (CSSE) course has been changed significantly but retained the same title. It may be worthwhile consulting students to obtain their view on the importance of this change.
- There was concern among postgraduates that the demonstrator rate had been reduced 23€ to 18€ without consultation or clear explanation. It is important to maintain the availability of high quality demonstrators.
- Improved Wi-fi access in the North campus is needed urgently, especially as almost all students now have laptops.
- More socket outlets are needed in lecture rooms, labs and public spaces to charge such laptops.
- Some of the better students felt there was too great a focus on Java in the first two years; other languages suggested were C, C++ and C#. Some compromise may be possible to stimulate high performing students, such as ensuring their involvement in competition work.
- Several students identified the need for greater provision of social space.
- Likewise, space for effective group work was identified as an issue.

Review Process

Finally, there are a few points in relation to the Quality Review process itself:

- The broad approach of the Review in covering teaching and learning, research and scholarship, and enterprise is a significant strength of this review process but there needs to be space in the interview schedule to ensure that each area is given sufficient attention. In practice, the Review focused largely on teaching. It seems desirable to shift the schedule more towards research and enterprise to achieve the required balance.
- In the UK, external review bodies would normally define the review process precisely. The Maynooth Quality Review Process is less prescriptive but might be improved if more responsibility for the schedule were placed on to the external

reviewers, inviting an early report on first impressions and building a schedule around what needs to be explored.

- It is difficult to run a Review without a Chairman. It may be better to nominate someone from the University for that role if it is impractical to select one of the appointed external reviewers.

Conclusion

The Review Group is very appreciative of the open way in which this review has been approached. As a result, it has been a very positive experience throughout. Hopefully, the recommendations in the report will be valuable in the Department's preparation of a new strategic plan and associated activities. There have been many areas of practice and achievement to commend but most importantly it has been a pleasure to see the support shown by students at all levels for the staff of the Department. Their engagement in the process and their articulate answers have been very impressive, reflecting well on the work of the Department and the standard being achieved by the University overall.

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Professor David Bustard   **Professor Robert Pooley**
External Reviewer   **External Reviewer**

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Mr Liam Cronin
External Stakeholder

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Dr Bernard Mahon   **Mr Cathal McCauley**
Internal Reviewer   **Internal Reviewer**