



**NUI MAYNOOTH**

Ollscoil na hÉireann Má Nuad

**Quality Review of the  
Department of Mathematics  
April 2009**

**Peer Review Report**

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# Peer Review Report on the 2009 Quality Review of the NUI Maynooth Department of Mathematics

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## 1. Introduction

This document is the Peer Review Report on the 2009 Quality Review of the NUI Maynooth Department of Mathematics. It has been written by the External Peer Reviewers (henceforth designated as «we»), in consultation with the External Stakeholder and the Internal Reviewers, and aims at assessing the activities and objectives of the Department of Mathematics (designated as «the department»).

This report is based on:

- a) The documents prepared by the department, in particular, the Self Assessment Report.
- b) A three days *in situ* visit that took place on March 31 - April 2, 2009.
- c) Other documents and information available on the University website and elsewhere.

The Self Assessment Report was prepared by the staff of the department on the occasion of the 2009 quality review. It is a 150 page document containing a global presentation of the department, its missions, challenges, past achievements, and future goals. We appreciate the effort taken by the department in preparing this document which we found very well organised and informative. The other documents which have been presented to us are internal documents of the department such as the Staff Handbook 2008/2009 which describes the various facilities available to the department members and the procedures that need to be followed, and the Student Handbook 2008/2009 and the Postgraduate Handbook 2008/2009, which contain course descriptions and practical information aimed at students.

We visited the department on March 31 - April 2, 2009. The visit was well planned and organised: we met with all members of the department mostly in small groups and in a few cases individually. We also met panels of graduate and undergraduate students, tutors, heads of other Academic Departments and we visited the department's building and its facilities. Everyone was present on time according to the agenda and fully co-operative. We felt free to ask any questions and they were comfortable to share with us their feelings, concerns, and comments on their work and the department.

We also found it informative to study the websites of the department and the Faculty of Science & Engineering and to consult the MathSciNet professional database.

Before commenting on the activities of the department, we wish to stress the excellent atmosphere among its members. The department is well managed and it is very well perceived by other departments in the University. It is an efficient, but also a happy department.

The missions and the values of the department are well aligned with those of the University and the Academic world in general. People there do what they should and they do it well.

## **2. Department's missions**

The aim of the department, as summarised on their website, is *to develop and disseminate mathematics, to transmit mathematical knowledge and skills, and to promote mathematics and its use.*

Concretely, the department of mathematics offers a large array of courses ranging from elementary university mathematics courses to graduate classes for MSc and PhD students. The number of students following courses taught by the department is close to 900 (corresponding to 350 full-time equivalent students - see the Self Assessment Report, page 120). The department is not only an important teaching unit, but it is also a successful research centre, mainly in pure mathematics, but also in statistics and education sciences. A third mission is the promotion and support of mathematics through various activities such as the Maths Week (designed to popularise mathematics among second-level students) and conducting training sessions for the annual International Mathematical Olympiad. Members of the department also devote some of their time and skills to professional associations such as the Irish Mathematical Society.

## **3. Structure, management and facilities of the department**

### **3.a Assessment**

The department staff comprises twenty-two (22) academic staff, sixteen of whom are permanent members and six of whom are under various contracts and associations. This team is completed by three full-time support staff. The department is located in Logic House where each member has an office. The building also contains three computer labs, a lecture room for seminars, a coffee room, and a library.

The size of the department makes it a manageable unit. All permanent members of the department who have been working there at least a year have some administrative duties, like course coordination, organisation of seminars, coordination of examinations etc. Although many administrative tasks are devolved to various members of the department, primary responsibility for management of the department lies with the Head of the department and the support staff. Here teamwork, proper communication, and flexibility seem to be key ingredients: while the main roles of the Head and the support staff are defined in a clear way, when appropriate each of them acts as a substitute for the others whenever needed. All in all, the department is efficiently run and the working atmosphere is very positive, the Head of the department and the support staff are highly appreciated among the staff and students.

We should stress however that the rather small ratio of professors to lecturers in this department could be a problem in the future. Although both lecturers and professors can do the same work, they have a different weight and prestige within both the institution and the outside world, and it would be no luxury if a department of this size had 3 or 4 full professors.

The computer labs and the library are used by the researchers and the students, the lecture room is used for the weekly research seminar and it is also a place for scientific discussions and interactions. Every professor, lecturer, and post-doc has an office which in general seems to be of a reasonable size, but there is a lack of space for visitors and for students. Due to this lack of space, the department can not invite scholars for long periods and is constrained in organising more academic activities.

The department is located in Logic House in the old campus. Although the building was «refreshed» less than a year ago, it is suboptimal in several aspects, such as a lack of air conditioning or adequate security for some of the computer labs. It should also be noted that the department is somewhat isolated from the Hamilton Institute and the Department of Mathematical Physics. It would greatly help creating interactions between these units if they could be located in the same geographic area.

The Department of Mathematics is not an isolated body of the University. It has relations with other departments, the Faculty and with the Central Administration. The mathematics department is well perceived by the heads of the other departments who are aware of the importance in quantity and quality of the mathematical teaching being offered to a large number of students following various curricula. Concerning the central administration we noticed that the Head of the department and the support staff have developed good relations with the people working in the central services, but there is a certain level of distrust of the central administration by the lecturers. The lecturers' perception is that the administrative burden is increasing, that lecturers are being asked to spend time on what seems to be unimportant matters and that the administrative support is often inadequate. The time spent on administrative duties is no longer available for research and that is a matter of concern for the academic staff.

### **3.b Recommendations**

- A better dialogue and mutual understanding between the central administration and the academic staff should be promoted.
- In the present situation, Logic House and its facilities should be properly and safely maintained. The budget for the computer labs and other high tech equipments should be sufficient and stable.
- The replacements of retiring academic staff should be guaranteed and the ratio professors/lecturers should be improved.
- In the (hopefully near) future, the department should move in to a modern, fully equipped building located near the Hamilton Institute.

## **4. Teaching**

### **4.a Assessment of the teaching**

- *Lectures.* The department is offering a rich supply of mathematical modules starting from the elementary university level and reaching the graduate level. The standard undergraduate mathematical curriculum is well covered and, given the relatively modest size of the department, the supply of graduate courses is very ambitious. We found the balance between the chosen topics appropriate. The department makes a valuable effort in supplying the students with adequate lecture notes and other teaching material. Most of this material is conveniently accessible via the Moodle platform. Some student evaluations can

be found in Appendix J of the Self Assessment Report, and these evaluations show that the teaching is globally well received by the students. Our discussion with the graduate students confirmed to us that the teaching is exciting and of high quality and that the lecturers are motivating and accessible. We should say, however, that our discussions with the undergraduate students had a different tone and were quite animated. Some undergraduate students expressed the feeling that some classes were too demanding and some assignments were too hard. This is not unexpected since studying mathematics at the undergraduate level can often involve some frustrations and it takes some time and maturation before a student really understands in depth some of the main concepts. We think, however, that the students might sooner develop a more positive attitude toward their studies if they have the feeling that their feedback (in particular, their concerns) are being heard and taken into account. While there are student class representatives, some other formal and/or informal meetings between a representative group of students and the academic staff may help a lot.

*-Tutoring.* Besides the lectures, the department offers various pedagogical supports to the students. We should stress the importance of the tutorial sessions where the tutor illustrates concepts taught in class with examples, discusses the homework with the students and answers their questions. We have appreciated the way the tutoring is organised and in particular the fact that the tutors are specially trained for the job. In practice, most tutors are advanced students and they told us how presenting basic concepts in tutorials helped them reach a deeper understanding of the material they had learnt in previous years. Tutoring is an excellent system and we only regret that due to budgetary reasons not more of it can be offered by the department.

*-The Mathematics Support Centre (MSC).* The MSC is a creative answer proposed by the department to the difficulties encountered by the students who lack some ability or background to follow the classes and to do their assigned homework. Instead of letting these students struggle by themselves in despair or to reduce the academic level in classes, the department has created the MSC where students can go on a voluntary basis to meet there a tutor to discuss his or her mathematical problem or question. The tutor is not there to solve the problem but to help the student find a strategy leading to its solution.

#### **4.b Strengths and good practices**

The Department of Mathematics at NUI Maynooth has developed a constructive approach toward helping and guiding the students whose mathematical backgrounds vary greatly and are sometimes very weak. Some students who start science with the idea that mathematics is too hard for them gain self-confidence and actually end up choosing mathematics as their major subject. The efficient tutoring system, and the way the tutors are trained is noted by us as a strong point of the department. The Mathematics Support Centre is a particularly noteworthy achievement and is an example that could be followed by other institutions. The MSC opened in October 2007 and it is still too early to collect statistical evidence of the positive impact it has on student performance, however the department is working on this issue and has already started to collect and compile early data, and the first conclusions are very encouraging. In the future, the department will continue to quantitatively monitor the impact of the MSC and reliable data will be published as soon as they will be available.

#### **4.c Concerns about possible issues**

The department as a whole is carrying a heavier and more complex teaching load than other mathematical departments in comparable universities. This is due in part to the fact that the first year students at NUI Maynooth are younger than in some other countries and their high school records in mathematics are often not very high. As a result, the lecturers in this department have to take care of some of the teaching and training that in other countries would be done in high schools.

Other sources of this complexity are the high number of distinct programmes leading to BSc or BA in Mathematics as well as the numerous service courses given by the department. This complexity seems at first sight to be somewhat artificial and unnecessary, but it is, in fact, justified by the need to offer an appropriate academic path to each individual student regardless of his or her starting level. Nevertheless the non-homogeneity of the student population following the same course can be hard to manage and is a possible source of stress on the lecturer.

We would like to stress an important issue concerning the facilities (discussed in Section 1 on pages 5-6 in the Self Assessment Report). To teach a good mathematical course requires an excellent environment: the teacher has to explain the subject and simultaneously demonstrate how the equations, calculations and mathematical arguments evolve from one step to the next. The best pedagogical tool for such teaching is the blackboard. A math teacher needs clean, well lighted large blackboards with an endless supply of quality white and colour chalks<sup>1</sup>. This comment may sound old-fashioned, but the fact is that other pedagogical methods such as using PowerPoint presentations are not as efficient because they prevent the students from seeing the teacher actually *doing* the math in front of them. That would be like a piano teacher never touching the piano keys<sup>2</sup>.

Due to budget difficulties, we sensed a certain anxiety among the academic staff about the future of the tutoring system and the Mathematics Support Centre.

#### 4.d Recommendations

- Demands on the lecturers are high. These could be partially reduced if the curricula were more stable (many changes have taken place over the last few years).
- The students could be given more opportunities to express their views and concerns to the department. We encourage the department to organise some form of discussions between a group of students and a group of lecturers to discuss issues such as the curricula, the demands on the students and the students' perceptions of the lectures.
- We suggest that a mathematical students' club or association be created. Of course, the dynamic should come from the students themselves, but the Faculty and the department may encourage and support this initiative by providing some working space and technical assistance (e.g. to create a website etc.). Such an association could organise some academic and social events suited to the undergraduate and graduate students.
- We strongly recommend that the tutorial system be maintained, at least, as it is today. If possible, more tutoring sessions should be offered to the students and smaller groups should be organised.
- The Mathematics Support Centre is a recognised success and its budget should as soon as possible be set on a sustainable basis. Its head should be offered a long-term contract and dedicated space and equipment should be granted to the MSC.
- We recommend that the university provides good blackboards and adequate lighting in the lecture halls used by the department.

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<sup>1</sup> An example can be seen at [http://upload.wikimedia.org/wikipedia/commons/3/34/Math\\_lecture\\_at\\_TKK.JPG](http://upload.wikimedia.org/wikipedia/commons/3/34/Math_lecture_at_TKK.JPG)

<sup>2</sup> Large blackboards in University lecture halls have appeared some 100 years ago. They may in the future be replaced by electronic boards connected to a computer, but such system should only be implemented gradually and after some experimentation in coordination with the lecturers.

## 5. Research

### 5.a Assessment of the research

The department's output in research is described in Section 2, pages 10-17 of the Self Assessment Report and detailed in Appendices A-D. Before we assess the department's scientific work, we need to comment on the methodology.

We should, in fact, humbly recognise that there is no objective way to «measure» the «scientific production» of a mathematical department or institute. The Self Assessment Report discusses, on page 10, the problems and weaknesses coming from using abstract metrics such as those obtained from citations indices and impact factors. We agree with that analysis and we consider that the Self Assessment Report and its various appendices present enough information on the department's scientific activity. We also consulted MathSciNet, which is the standard professional database used by working mathematicians. The information we have retained concerns the quality, quantity and variety of publications in international journals with refereeing system, the grants and awards obtained, and the participation in, and organisation of, mathematical conferences.

*Scientific Publications.* The department's publications are listed on 10 pages in Appendix A. All papers listed are published in refereed journals. Some of these journals are among the worldwide top mathematical journals and a majority of these journals are among the 10 % best journals (there are more than 600 mathematical journals worldwide, and only high quality research is published in the best 60 or 80 journals). A few articles are also published in local journals, encyclopedia and conference proceedings, which should also be encouraged.

*Grants and awards.* Over the last six years the department has obtained more than €2000000 in grant money from the Science Foundation Ireland and other sources. This is a very substantial amount which is used to finance two post-docs and a lecturer. This money is also used to finance invitations and participation in conferences.

*Talks, meeting and conferences.* Appendix C contains a list of talks given by department's members in various places and occasions. Meetings attended by the staff are listed in Appendix D. These lists reveal that the members are very active, their work is recognised and they are invited all over Europe and North America, as well as Japan, China, India, Russia and Australia. The department's members have also co-organised as many as 14 scientific meetings over the last three years.

Besides these factual data, we also recorded the impressions of the post-docs. Post-docs are young researchers coming from other universities for a couple of years to do research and start their scientific careers; they are in good position to have a fresh view of the department. Both post-docs told us that they found an excellent scientific environment in this department. They are productive and are highly satisfied with their choice of coming to Maynooth.

The global picture is that of a very active research unit whose members have a vast international network and recognition. The quantity, diversity, and quality of the publications is very good, it has improved over the last couple of years and, given the young age in average of the department's members, it has the potential to further improve and be recognised as an excellent department among comparable size mathematical departments.

## **5.b Recommendations**

- We would like to encourage the department to be bolder and more assertive as a research unit. This could be done through a number of symbolic actions aiming at more visibility within and outside the University (such as occasionally inviting a prestigious mathematician on the campus).
- Although the department and the Hamilton Institute pursue different goals, it would be good to have more cooperation between them. A concrete starting point could be to set a common colloquium once or twice each semester.
- The department should also try and attract more PhD students.

## **6. Services to the community**

### **6.a Assessment**

The services to the academic and other communities offered by the department are described in Section 4 of the Self Assessment Report. Appendix G containing the staff profiles is also informative on this topic. Let us first stress that the primary service offered by a mathematical department is educational: all Science students and some other students need to develop some competences in mathematics and this is something they obtain from the mathematics department. The NUI Maynooth Mathematics Department is also willing and competent to develop specific teaching modules for other departments such as an epidemiology modelling course targeted at the MSc programme in Immunology and Global Health, or other modules for engineering, economics and psychology students. We also find it noteworthy that this department offers a concrete contribution to the life and promotion of the Irish culture by offering a mathematical class in Irish (it is possibly the only advanced mathematical course worldwide in a Celtic language).

Besides their teaching mission, the members of the department actively contribute to University and community life in numerous ways such as: doing administrative and academic work for the University, the Irish Mathematical Society and the Irish Statistical Association, refereeing and reviewing scientific articles for various journals, promoting science and conducting training sessions for the annual International Mathematical Olympiad for high school students, supporting the University's Foundation Science Course, collaborating with the national museum and radio programmes on science. Some members are first aid or fire warden volunteers, while others work on health and safety or sport campaigns.

### **6.b Recommendation**

Our sole recommendation on this topic is to make it visible somewhere (and not only in internal reports). For instance, the department's website could mention that one of the aims of the department is to offer a number of internal and external services and give a few examples. A complete and regularly updated list of what is being done by the Department should be made available somewhere.

## **7. Comments on the Department's strategy for its future**

### **7.a Assessment**

The department's view of its future is exposed in Sections 6, 7 and in Appendix K of the Self Assessment Report. The department is well aware of its strong points and its goal is mainly to sustain and develop those strengths. Some new projects are however also in view.



### **Some of the points to sustain and strengthen are:**

- To maintain and where possible improve the undergraduate and graduate offerings. Improve the use of internet platforms such as Moodle and maintain the tutoring system.
- To further develop the Mathematics Support Centre and other learning supports.
- To maintain and develop a strong research profile. Publish high quality research, attend and organise scientific events and apply for research grants.
- To encourage talented students to choose mathematics and promote the subject in all its aspects.

### **Some new and future goals are:**

- To develop a new Masters programme in mathematical education. This programme has been designed in collaboration with the University of Cambridge whose staff will teach one third of the classes. It will target second-level mathematics teachers and is due to start in September 2009.
- Another project is to develop a Masters in Financial Mathematics. However, due to the present situation in the finance industry, the department has wisely decided to postpone any decision on this matter for the time being.
- The department strongly hopes that some positions will be open in the near future. Its strategy is to try and attract the best possible mathematicians and statisticians, keeping in mind that the candidate should not only be a top researcher, but also a competent and motivated teacher.

## **7.b Recommendation**

We approve the strategic goals of the department and we would like to add the following list of suggestions for the future development of the department:

- Promote mathematics graduates in the professional world (perhaps in coordination with the University Career Centre). Mathematicians can be successful in many careers, but they may need some help at the beginning to learn how to get in touch with the right people, to write a CV and to confront the job market.
- One of the important goals of the department should be to try to attract more graduate MSc and PhD students.
- The project of introducing a Masters in Financial Mathematics is valuable and should not be abandoned. However the actual financial crisis impose a lot of considerations and caution and it would be wise to think about such a programme in broader terms. Such a new programme could include a strong component in statistics (which is a strong point of the department) and/or actuarial sciences (in coordination with the department of Economics, Finance and Accounting).
- If the full potential of the department as a research centre is to be attained, the teaching and administrative load on the academic staff should be maintained at its present level or lowered.

## **8. Conclusion**

The Peer Review Group has been impressed by this department, the way it sees its missions, its engagement in achieving its educational and research goals and its devotion to serving the community. The department is wisely managed and its members work in good harmony. We have observed however that although its resources are presently sufficient, these are suboptimal and it would be very hard for the department to maintain its quality on a sustainable basis should its allocations be reduced. We, in fact, strongly support the idea that its resources be increased as soon as the University's financial situation makes it possible.

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**Professor Ilkka Holopainen**  
External Reviewer

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**Professor Marc Troyanov**  
External Reviewer

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**Dr Declan O’Keeffe**  
External Stakeholder

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**Professor Peter Denman**  
Internal Reviewer

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**Dr Bernard Mahon**  
Internal Reviewer

## **Appendix: summary of the previous recommendations**

### *Structure, management and facilities of the department*

- A better dialogue and mutual understanding between the central administration and the academic staff should be promoted.
- Logic House and its facilities should be properly and safely maintained. The budget for the computer labs and other high tech equipments should be sufficient and stable.
- The replacements of retiring academic staff should be guaranteed and the ratio professors/lecturers should be improved.
- In the (hopefully near) future, the department should move in to a modern, fully equipped building located near the Hamilton Institute.

### *Teaching*

- Demands on the lecturers are high. These could be partially reduced if the curricula were more stable.
- The students could be given more opportunities to express their views and concerns to the department. We encourage the department to organise some form of discussions between a group of students and a group of lecturers to discuss issues such as the curricula, the demands on the students and the students' perceptions of the lectures.
- We suggest that a mathematical students' club or association be created. The dynamic should come from the students themselves, while the Faculty and the department may encourage and support this initiative.
- We strongly recommend that the tutorial system be maintained. If possible, more tutoring sessions should be offered to the students and smaller groups should be organised.
- The Mathematics Support Centre is a recognised success and its budget should as soon as possible be set on a sustainable basis. Its head should be offered a long-term contract and dedicated space and equipment should be granted to the MSC.
- We recommend that the university provides good blackboards and adequate lighting in the lecture halls used by the department.

### *Research*

- We would like to encourage the department to be bolder and more assertive as a research unit. This could be done through a number of symbolic actions aiming at more visibility within and outside the University.
- Although the department and the Hamilton Institute pursue different goals, it would be good to have more cooperation between them. A concrete starting point could be to set a common colloquium once or twice each semester.
- The department should also try and attract more PhD students.

### *Service to the community*

- The department's website should mention that one of the aims of the department is to offer a number of internal and external services and give a few examples. A complete and regularly updated list of what is being done by the Department should be made available somewhere.

### *Department's strategy for its future*

- Better support for mathematics students preparing to enter the job market.
- The project of introducing a Masters in Financial Mathematics is valuable and should not be abandoned, but it would be wise to think about it in broader terms. Such a new programme could include a strong component in statistics (which is a strong point of the department) and/or actuarial sciences (in coordination with the department of Economics, Finance and Accounting).
- If the full potential of the department as a research centre is to be attained, the teaching and administrative load on the academic staff should be maintained at its present level or lowered.