Good Research in Mathematics and Statistics

by Research and Graduate Studies Committee

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1 Introduction

Research activity, along with all academic activities, has been a focus of increased scrutiny over recent years. Quantitative measures of research output, ranging from paper counts to citation factors, have been used by funding bodies, university administrations and government quality agencies in an attempt to differentiate between the quality of research produced by different individuals and departments.

Most mathematicians and statisticians would argue that the abovementioned measures give, at best, a crude indication of the quality of research output and that the only people who are really in a position to assess the quality of their research output are their peers in the discipline.

There are a number of ways in which a mathematician and statistician might produce research of exceptional quality. To take two extreme examples, Andrew Wiles published an average of a paper a year over 13 years before he proved Fermat’s Last Theorem, and yet his achievement is arguably the most significant mathematical result of the late twentieth century. On the other hand, Paul Erdos published over 1500 papers, the great majority in collaboration with colleagues all over the world.

The purpose of this document is for the Department of Mathematics and Statistics to make a statement describing the characteristics it values in mathematical and statistical research. As pointed out above, there are a number of alternative ways in which to achieve quality in this area, so it is not necessary that someone have a record of achievement in all areas. However, an academic who is performing well in research should be able to point to achievement in at least some of the following.

2 Publications

Mathematicians and statisticians produce several types of publications. The most common are publications for international refereed journals. We also publish conference proceedings, but less than engineering and computer science researchers. Many mathematics conferences do not publish proceedings. Scholarly books are rarely produced.

2.1 Research publications in international refereed journals

Mathematicians and statisticians publish in a wide range of journals, from mathematics and statistics journals to journals covering the applications of the discipline, in the areas
of engineering, chemistry, physics, medicine etc. The variety of contributions is of high value.

Journal impact factor as assessed by the ISI is not a good measure of a journal’s standing, since this only takes into account the number of citations in the year following publication. Mathematics, statistics and their applications rarely have this speed of impact. In fact some of the most prestigious mathematics journals have low impact according to this measure.

The issue of the ordering authorship is frequently judged to be important by those compiling quantitative measures of research output. In mathematics and statistics, it is common, but not universal, to use alphabetical ordering of authors. It is also common to use the level of contribution, going from highest to lowest. Moreover the nature of mathematics research is such that results reported in a joint paper are frequently the product of “brainstorming” sessions attended by all authors. In this context, it can be argued that the result would not have been produced if there had not been a contribution from all authors and that attempting to apportion different proportions of the idea to each of the authors is a fruitless exercise.

There can be a considerable time lag between manuscript submission and acceptance and subsequent publication. This time lag should be kept in mind, especially when the performance of an early career researcher is assessed.

3 Funding from grant agencies, ARC, NHMRC, other

The major use of grant money in mathematics and statistics is to fund employment of postdoctoral fellows and other staff. The existence of such funding is essential for the development of young practitioners in the disciplines, so it is very important that mathematicians engage in the grant application process.

One consequence of the fact that mathematicians and statisticians generally do not need expensive experimental equipment is, however, that they generally apply for less funding “per application” than other disciplines. It is thus a mistake to judge success in obtaining grant money by looking at the total funding earned. It is better to look at the number of successful applications.

4 Postgraduate training of PhD and Masters students

An important role of academics is their contribution to the creation of an environment conducive to the training of higher degree students. In each case, the future of a graduating student may be in a profession, in industry, in further study or in an academic career.

A good measure of the effectiveness of a higher degree by research program is the number of students graduating, in a timely fashion, and with high prospects of employment or further study. The quality of graduates is paramount and should not be sacrificed in the interests of other objectives.
Increasing pressure on resources means that increasing levels of efficiency are required in the process of selecting and training students, and so increasingly the creation of a healthy research environment in the department is essential. Increasingly students will be entering with a background from other universities, national or international, leading to changes in the role of a supervisor.

For academic staff, good practice involves close interaction with students from the first prospective stage, to the student’s first post-degree job. Assessment of a student’s background is critical, as is interaction to determine personality compatibility. Clear understanding of application and candidacy procedures are paramount.

Supervisors should be prepared to advise students of suitable projects, professional development opportunities at the university, play a mentoring role, particularly for international students with a different cultural background, provide an environment facilitating interaction with other students, and provide networking opportunities for students to present their work and interact with their peers departmentally and at conferences.

5 Honours supervision

In the Department of Mathematics and Statistics, the honours program currently consists of 75% coursework and 25% project work. Students undertake Honours for a variety of reasons, and a supervisor should be involved in guiding a student to achieve their goals. Honours projects need to be carefully selected to suit the needs, background and abilities of the student. Honours also plays a very valuable role in determining the skill set of a graduate, with opportunities to plan and manage a project, work with a supervisor, write a small thesis and present work. These are valuable skills to encourage during Honours supervision.

In the case of prospective graduate students, encouragement and mentoring should be commenced as early as is practical, so that the background obtained by the student is as strong as possible. Such students should be encouraged to consider themselves new members of a research community.

6 Organising learning courses for honours and postgraduate students

With increasing numbers of graduate students, presentation of graduate courses and seminars is viable. To be competitive with graduates from larger foreign universities, an efficient balance between breadth and depth of the postgraduate training experience needs to be found. Visitors can provide a new perspective on a specialised topic and should be encouraged to give seminars or a short course to postgraduate students.
7 Refereeing and examining

Refereeing of papers for national and international journals is the other side of having our own papers refereed and published in leading journals. Similarly, acting as a referee or reader for granting bodies, such as ARC is an important contribution to research culture. Postgraduate degree examining is also an important activity. Such activities involve a considerable workload and the responsibility is a serious one.

8 Editorial activities

Being an active member of an editorial board of a journal or a conference proceedings provides a valuable contribution to the wider research community. To be invited to be part of an editorial board is an expression of recognition by the academic community. These positions involve a considerable workload and the responsibility is a serious one.

9 Invited speaker

Invitations to speak and/or contribute a paper to a conference can be very prestigious in some areas of mathematics. The refereeing process for contributions to many pure mathematical conferences can be more strenuous than for journal contributions sometimes requiring two separate refereeing processes. An invitation to speak at particular conferences can be an accolade equivalent to winning a prize, and implies that the mathematical community judges your work amongst the best in the world. Of course this is not always so and the level of importance of conference participation varies considerably but the above needs to be kept in mind when judging an academic’s record.