Math matters

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How others see us

For the past 15 years I have been a professor at the University of Newcastle, which is by Australian standards a medium-sized university with serious research ambitions. As the only professor of mathematics in the university, I have served on numerous selection committees, promotion committees and research committees. For the past year, I have been a member of the ARC panel on Mathematical, Information and Communication Sciences. Being forced to repeatedly explain to colleagues from other disciplines how mathematicians operate, and watching these colleagues' reactions to my explanations, have led me to question how well we are presenting ourselves and our work to the wider scientific community. I have gradually come, somewhat reluctantly, to the conclusion that we as a profession have some kind of masochistic desire to shoot ourselves in the foot.

Our colleagues, especially those from other sciences, instinctively assess our promotion and grant applications using the criteria they know work well in their own disciplines: the number of publications (especially those as first author), success at attracting and supervising research students, and the total value of external research grants obtained[1]. It is obvious to us that only an exceptional young mathematician could ever compete with a biologist or physicist on these terms, but of course our colleagues don't see it that way. My main suggestion here is that, instead of just getting ourselves a miserable reputation by bleating about the unfairness of life, the universe and everything, it might be more constructive to look at how our scientific colleagues conduct their affairs and ask whether adopting some of their practices might help us do our job better.

The first criterion which is widely used for assessment is the list of publications. We (that is, mathematicians) agree that the typical mathematician publishes less than other scientists of similar calibre. Some of the reasons for this are inherent to our subject and are defensible, others less so. For example, justifying good mathematics often involves a lot of detailed argument, and therefore the results appear in a few long papers rather than many short ones. Our colleagues usually accept this point. On the other hand, in many cases the real reason is simply that we are slow: slow to write up our results, slow to referee them, and slow to print them. These points we could work on, and should.

The problem with our slow publication rate begins when we are PhD students, when the goal of writing a thesis looms so large everything else is forgotten. An important part of the research process, though, is writing papers and submitting them for publication, and getting the knack of this process should be part of the "research-training" which our PhD programs are supposed to deliver; it certainly is in the sciences and in engineering. We too should be demanding[2] that our PhD

[1] More recently, as Tony Bracken observed in the *Gazette's* last issue, we are under pressure to compete on citation counts and journal impact factors too. We do even worse on these new criteria, largely because mathematicians cite substantially less than every other discipline [1]. Why is this?

[2] OK, OK. I realise that "demanding" things of PhD students gets you nowhere...

students write their results up and submit them for publication while they are still students[3]. Far too many talented mathematicians with five or ten years of postdoctoral experience have only a handful of published papers to show for their efforts.

Slow refereeing has always been a problem in mathematics, and anecdotal evidence suggests that it may be getting even worse — I often hear (and experience!) horror stories involving delays of 2, 3 or more years before an editor finally makes a spot judgement in the absence of any report from a referee. My suggestion here is that we modify our expectations of referees: it should be made clear that they are not responsible for checking results, proof-reading or editing, but merely for deciding whether the paper has intellectual content, is readable, and is appropriate for the journal in question[4].

The second commonly used criterion, that of attracting and supervising research students, is often problematic for mid-career mathematicians. This is partly unavoidable, since we are dependent to some extent on the existence of suitable candidates. But we could maybe improve the situation by learning from our scientific colleagues, who typically get junior colleagues, postdocs and senior students actively involved in the research projects of their younger students. The potential benefits of such an approach are huge: supervisory experience for the junior researchers, more impetus for the students' projects, and better research outcomes for everyone[5]. We could also do more to attract students by using research funds to make more scholarships available. This brings me to...

The third criterion: that of attracting external research funding. There is a general feeling among mathematicians that it is much harder for a mathematician to get an ARC grant than it is for other scientists. The usual response from ARC representatives is that the success rate in mathematics is much the same as it is in other disciplines. My own view, for what it's worth, is that both statements are correct. However, I have seen no evidence that the ARC or its panel members intend to discriminate against mathematics. It is hard for mathematicians, partly because of our publication records (see above), but mostly for the simple reason that not enough of us bother to apply for grants.

This problem, therefore, is one that our community can fix merely by adopting standard scientific practice. In other disciplines, every active researcher submits at least one proposal every year. Mid-career mathematicians, on the other hand, typically think first about whether they have any chance of success, then about how much work it will take to write the proposal, and thereby talk themselves out of applying. Australia has some truly outstanding mathematicians, and they naturally dominate the top end of the list every year, as indeed they should if the system is working. But as a result, promising and hard-working younger researchers who really need the support, encouragement and track record regularly miss out, and eventually stop applying.

This is not the considered response one would expect of professionals. If we believe that our subject is important and that our research is worth doing (and if we don't why the hell are we here?), then we must learn to play the game the way the professionals do. We as a community should be putting pressure on all our active researchers to think hard about how they could improve their research with extra resources, and then to

[3]... but we can offer the carrot that it will be much easier to write the thesis if they have this experience and a couple of papers to cut-and-paste from.

[4]When I espoused this view to a friend who is the Managing Editor of a major journal, she shook her head and said: "Sorry, Iain, but this means you are no longer mid-career." Harsh but true.

[5]There is evidence that we are gradually moving away from our "eccentric loner" model of research [2], but there is much more we could do.

ask the ARC for these resources by submitting a proposal. Every year. Whenever we ask ourselves whether it is worth the effort, we should imagine how much healthier Australian mathematics would be if we had twice as many postdocs, twice as many international visitors and twice as many PhD students. We would all benefit from the flow-on effects[6].

Some of the suggestions I have made involve changing the mind-set of our profession, and are therefore not completely within the control of the mathematical community in Australia. Some of them, though, are very much in our control. I believe that changing local mathematicians' attitudes towards publication and grant applications could in the relatively short term substantially boost our standing in the Australian research community. Our young people would then find it easier to find positions, fund their research and get promoted. And our Deans might even allow us to replace some mathematicians when they retire.

References

[1] I. Podlubuy, *A note on comparison of scientific impact expressed by the number of citations in different fields of science*, http://uk.arxiv.org/abs/math.ST/0410574.

[2] J.W. Grossman, *Patterns of research in mathematics*, Notices Amer. Math. Soc. **52** (2005), 35–41.

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[6] Especially if the successful applicants remember that their success depended on the efforts of their unfunded colleagues, and allow these colleagues to share the flow-on funding (or whatever tiny fraction of it reaches the mathematical coal-face in their university).