

Reaction to Donald McClure's "Employment Experiences of 1990–1991 U. S. Institution Doctoral Recipients in the Mathematical Sciences"

Benjamin Lotto and John C. Polking

When I read Donald McClure's article ("Employment Experiences of 1990–1991 U. S. Institution Doctoral Recipients in the Mathematical Sciences"^{*}), I do so as someone who is very concerned with the continuing employment crisis facing new and recent Ph.D.s on the job market. In particular, I look to the data in McClure's article to shed light on two questions: How severe is the current employment crisis for doctoral recipients in mathematics, and what approaches can we take to help alleviate that crisis?

There is substantial evidence that starting in 1990–1991, doctoral recipients in the mathematical sciences have faced a declining job market. The data in Table 3A shows that out of 891 1990–1991 doctoral recipients whose employment status was known in the first fall after the receipt of their doctorate (Fall I), 63 (7%) were still seeking employment. For comparison, previous Annual Surveys show a fairly steady rate of 2% still seeking employment. As McClure notes, the 7% figure is somewhat deceptive, as it fails to include part-time positions as well as "mercy hires," individuals hired for one year by the department awarding them their degree in hopes that they will do better in the job market the following year. These people, as well as those taking one-year positions at institutions other than those that awarded their degree, start looking for their next job in October, almost immediately after the start of the school year. Because of

^{*}Notices, *July 1995*, p. 754.

this, it seems to me more realistic to combine this group with those still seeking employment. Borrowing a term from McClure, I call the combined group "underemployed." According to the 1991 Annual Survey, forty-five individuals held a position in the department that awarded their degree. Most of these are probably mercy hires, so the underemployment rate is at least 11%. Including part-timers and those in other one-year positions would yield an even higher estimate of the underemployment rate, perhaps 20% or even higher. This statistic indicates the magnitude of the crisis in employment for doctoral recipients in the mathematical sciences.

Tables 4A and 4B show where the 1990–1991 doctoral recipients were employed in Fall 1993. Out of 798 people whose employment status in Fall 1993 is known, 86 (11%) are listed as still seeking employment. McClure states that most of the data were collected before Fall 1993 and so almost certainly some of the people in this category subsequently found employment. However, a high rate is alarming and seems to indicate that even with two years of experience, employment prospects remain dim for a large percentage of doctoral recipients.

Among the 686 doctoral recipients who were employed in the U.S. in Fall 1993, 193 (29%) were employed by doctorate granting academic departments or research institutes. The remaining 487 (71%) were employed by other academic departments, government, or industry. These figures stand in stark contrast to the fact that most

doctoral programs (especially the top programs) train students almost exclusively towards research positions at doctorate granting academic departments. A large number of doctoral recipients end up at academic institutions where teaching is a priority; however, doctoral students tend to get very little training as teachers. In addition, it is a commonly held attitude among both faculty and students in doctorate granting departments that teaching is an annoying but necessary duty that one should spend as little time as possible on because it interferes with research. The figures above also indicate that a large number of doctoral recipients end up working for government or in industry; however, there is virtually no information available to doctoral students on opportunities outside of academia. In addition, there is severe prejudice among both faculty and staff in doctoral programs against positions outside of academia and a student who is interested in pursuing a nonacademic career will be shunned or met with blank stares. It seems likely that the distribution of jobs taken by doctoral recipients will not change very much over the next few years; in fact, if we wish to lower the unemployment rate for doctoral recipients, it seems clear that the additional jobs will not be in academia, but in industry. Doctoral programs need to adapt themselves to the reality of the job market by preparing students for the wide variety of employment options they will face and by guiding students to career paths other than doctorate granting academics if it best suits their talents and interests. Specifically, faculty in doctorate granting departments need to educate themselves about all of the different employment opportunities for Ph.D.s and take a broader view of the profession so that they can better serve the students they supervise through their program.

As a quick side note, the poor response rate (38%) by nonacademics in the survey as reported in Table 2 is indicative of the communication gap between academia and industry. The negative attitude of academics towards industry that I mentioned above is, in my opinion, a strong contributing factor to this gap. Mathematicians in academia and in industry need to cooperate more and bridge this gap. In addition to generally strengthening the profession, there is a good chance that stronger connections between academia and industry will provide more employment opportunities for doctoral recipients.

Table 5 provides more evidence for the need for graduate programs to adapt to the changing realities of the job market. Out of 176 people who had employment in doctorate granting department or research institutes in the first fall after receiving their doctorate and who changed em-

ployment by Fall 1993, 111 no longer held a position in this category. On the other hand, out of 225 people who started with employment somewhere *other* than a doctorate granting department or research institute, and who changed employment by Fall 1993, only eleven had moved to positions in such a department or institute. The conclusion is that even if your first job is in a doctorate granting department, it is likely that your second job won't be—and when you go through that second search, it would be invaluable to have the breadth of training necessary to compete for a wide variety of jobs.

Tables 6A and 6B report the tenure status of our doctoral recipients both in the first fall after receipt of doctorate and in Fall 1993. During this period, the number of people in non-tenure eligible positions dropped by 153 (from 264 to 111). Even if we assume that some of the people in this group had three-year positions and left to pursue another employment opportunity, the indication is that many of these people had one- or two-year positions and then either found a tenure-eligible position, a nonacademic position, or became unemployed. Among the remaining 111 people who had non-tenure-eligible positions in both the first fall and in Fall 1993, there are undoubtedly a great many who had a one- or two-year temporary position and just moved to another temporary position. These short term, temporary positions are damaging to the professional development of the employee (who must spend much of the time in that position looking for a new job) and to the profession as a whole (because the efforts of talented, young mathematicians are spent job hunting rather than contributing to mathematics). Departments should do whatever they can to shift these positions to longer terms, preferably three years.

As a final note, I would like to add that I believe that this kind of follow-up employment survey is valuable and should be continued and even expanded. For example, it would be useful to have data on the types of positions that doctoral recipients have at various points after receiving their degrees, allowing one to distinguish between, say, a prestigious postdoctoral position with a reduced teaching load and an exploitative temporary position with an inflated teaching load. It would also be useful to know what has happened to our group of 1990–1991 doctoral recipients in the two years since this survey was taken.

—Benjamin Lotto

Benjamin Lotto is assistant professor of mathematics at Vassar College, Poughkeepsie, NY. His e-mail address is belotto@vassar.edu.

I will address two issues raised by the careful, systematic study of Donald McClure. The first is my interpretation of the broad implications for the mathematics community, and the second is a suggestion for further study.

The McClure survey provides a useful picture of the the employment situation for Ph.D. mathematicians. It provides information that has not been available heretofore and therefore adds to our knowledge of the problem we are facing. However, the primary interpretation to be made is no different than the interpretation of previous surveys, and that is that there is a severe mismatch between the numbers of Ph.D.s we are producing and the numbers of academic jobs available.

The U.S. mathematics community will have to adjust to this reality by decreasing the number of Ph.D.s granted and by better preparing our Ph.D.s for nonacademic jobs. The most effective way of decreasing the number of Ph.D.s is by advising our undergraduate students of the realities of the job market. This is occurring already, but we will not see the full effects for a couple more years because of the length of time it takes to get a Ph.D.

The strategy of better preparing our students for non-academic jobs is harder to implement, since most of us have no idea of what will be required. Nevertheless it is the one that I think has more merit, simply because, if we are successful, the possibility of non-academic jobs will provide a buffer which will prevent the occasional increase in Ph.D.s from causing the problems we currently face.

If you look at the problem in its best light, what we are trying to do is to find jobs in the U.S. economy for a couple of hundred people who have demonstrated their intelligence and problem solving capabilities in the process of getting a Ph.D. in mathematics. That doesn't sound too hard. Of course from a different point of view, our Ph.D.s are not trained in any way that prepares them for a non-academic position.

We can start by advising all of our prospective Ph.D.s to apply for non-academic jobs in addition to their academic applications. The process would increase the options of our graduates and, through the feedback we get, increase our own understanding of what needs to be done. We can start by taking advantage of those individuals who have found jobs outside of academia, and in this regard I want to commend the fine article by Mark Winstead in the June 23 issue of the *Young Mathematicians Network Newsletter*.

The real problem is that we do not know what is required to better prepare our students. Here is where the AMS can perform a useful task. Somewhere among our membership we must

have the expertise needed to design a graduate program which will better suit the needs of the Ph.D. of the future.

While the McClure study is useful, it only partially answers the questions that I have about the dynamics of the job market for young Ph.D.s. In particular the study does not really come to grips with the impact of postdoctoral positions in mathematics. I include here the named Research Instructors/Assistant Professors at leading research departments, postdocs at the several institutes, and postdocs in academic departments, usually in areas of applied mathematics. These positions are among the most attractive for new Ph.D.s, and seem to provide an excellent start in a mathematical career. They share the features of being non-tenure-eligible, and of two or three years in duration.

It is my impression that the lucky individuals who start in postdoctoral positions usually have little difficulty finding appropriate jobs afterwards. They develop a sense of who they are and where they belong in the mathematics world. Those who want them seem to be able to find tenure-track jobs at appropriate schools. Many institutions limit their hiring for tenure-track positions to people currently holding postdoctoral positions, and frequently do not even look at new Ph.D.s. The result is that the new Ph.D.s who do not start in the postdoctoral positions have great difficulty, often ending up as academic nomads in a sequence of one-year positions.

If my impressions are correct, the situation would be improved by creating more postdoctoral positions to ease the way for a greater percentage of our new Ph.D.s. If these positions were created by using money currently being used to support graduate students, or by converting a senior position into two postdoctoral positions, there would also be an increase in jobs available. However, this effect would not be nearly enough to solve the entire employment problem.

I would like to see if my impressions are supported by the data. The McClure survey, coming only two years after the Ph.D., was too early to answer the questions that I raise. I think it would be a good idea to repeat the survey now, four years after the Ph.D., in order to get a realistic view of the job dynamics of new Ph.D.s.

—John C. Polking

John C. Polking is professor of mathematics at Rice University, Houston, TX. His e-mail address is polking@rice.edu.