Attracting Ph.D.'s to K–12 Education

Are you—or is someone you know—a current Ph.D. student or new Ph.D. with an interest in K–12 education? Would you want to have a two-year postdoctoral fellowship to test your interest and ability in K–12 education? A recent report by a committee of the National Research Council of the National Academy of Sciences (available at `http://www.nap.edu/catalog/10433.html`) highlights the positive impact of a new program to attract science, mathematics, and engineering Ph.D.'s to careers in K–12 education. This report represents the second phase of a three-phase project to explore the possibilities of attracting Ph.D.'s to K–12 education in formal educational settings as well as informal ones, such as science museums. The first phase of the project surveyed recent Ph.D.'s in science and mathematics to gauge their interest in pursuing careers in secondary education. Analysis of this data suggests that a significant percentage of Ph.D.'s would be interested under the right circumstances.

The second phase of the project presents the case for pilot programs for preparing Ph.D.'s to be productive members of the K–12 mathematics and science education community. The focus is not on unemployed Ph.D.'s. Rather, the focus is on those who toward the end of their Ph.D. studies develop a strong interest in K–12 education and wish to reorient their career intentions in this direction. These Ph.D.'s may become K–12 teachers but more than likely would become mathematics and science specialists who help improve teachers' content knowledge and understanding of the processes of mathematics and science. Such specialists may also be the next generation of college faculty in arts and sciences or engineering who work closely with schools of education to prepare teachers with strong mathematical-content knowledge.

In phase three, pilot programs will be sponsored in some states to support new and recent Ph.D.'s as postdoctoral fellows for two years as they learn classroom practice and pedagogy and work under supervision as teachers in schools. It is expected that federal agencies and foundations will fund the national program, which will support the first year of the fellowships; the school systems will support the second year.

Both in the phase one survey and in focus groups convened by the committee for the second phase, many current Ph.D. students and recent Ph.D. recipients conveyed a great deal of interest in K–12 education. They also indicated that working in K–12 education does not garner much respect. However, those surveyed and consulted believe that a prestigious national fellowship could have an enormous impact on the way Ph.D.'s in K–12 education would be perceived by the mathematics and science community at large. Extraordinary mathematicians, like AMS President Hyman Bass, who have turned their attention to elementary mathematics education, are providing great validity for research mathematicians who work in K–12 education. Since September 11, 2001, more and more young people are searching for ways to serve society, and teaching is one such way; thus teaching has become a much more appealing profession. Nationally, the number of bachelor's degree recipients returning to college to obtain teaching certification has nearly doubled this year. The teaching licensure program at the University of Colorado at Denver enrolled more than 350 students in fall 2002, compared to 150 the previous year, and half of them want to teach mathematics and science at the middle and high school levels. The downturn in the technology economy accounts for some of this increase, but surveys indicate that more of it comes from the response to 9-11.

Is it possible for someone to move into the K–12 education arena after having gone through a long, demanding, difficult Ph.D. program in mathematics that required a narrow concentration on problems at the cutting edge of his or her subfield? The committee that wrote this report believes the answer is yes, with help. The ingredients necessary for such a transition include a thorough grounding in how to teach, whether or not the Ph.D.'s actually become teachers, and a fundamental understanding of schools and classrooms in this country.

Fully one-third of the graduate students and postdocs surveyed in phase one have considered K–12 education. What are the "right" circumstances that would encourage mathematics Ph.D.'s to participate in a pilot program of the type described in the report? One is the opportunity to secure a prestigious national fellowship that would give them credibility with their peers and with mathematics faculty. Secondly, they need support and encouragement from people who are in the K–12 education system and from researchers so that the fellows can continue their research should they choose to do so.

Planning for the pilot programs is now under way, and an announcement about the availability of the fellowships should appear in spring 2003. Mathematics Ph.D. students and recent Ph.D. recipients are encouraged to apply for these fellowships. The rewards are great.

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Letters to the Editor

Galois Fields

I would like to do justice to Évariste Galois, whose role in introducing finite fields has been misrepresented in Shreeram S. Abhyankar's charming article "Three ways of measuring distance, three orbits, three subdegrees, or the great theorems of Cameron and Cantor" [August 2002]. In fact, not only the finite fields of prime order were discovered by Galois, but full credit should be given to him for constructing finite fields in general. In one of the few papers published during his short lifetime, entitled "Sur la théorie des nombres", which appeared in the *Bulletin des Sciences Mathématiques* in June 1830, Galois—at that time not even nineteen years old—defined finite fields of arbitrary prime power order and established their basic properties, e.g. the existence of a primitive element. So it is fully justified when finite fields are called Galois fields and customarily denoted by $GF(q)$. It is also worth mentioning that he used this concept for investigating the solvability of primitive equations.

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Shortage of Doctorates in Mathematics Education: An Update

During the last two years the shortage of doctorates in mathematics education has been reported in the *Notices* (see November 2000 and February 2002). This letter provides a brief report from a recent survey of positions in mathematics education. About 95 percent of the 88 institutions announcing 111 positions for doctorates in mathematics education responded. The findings were consistent with survey results reported for the two previous years; namely, the shortage of doctorates in mathematics education continues. In fact, it may be getting worse.

More specific findings include: (1) The positions are about evenly split between appointments in mathematics departments or schools of education. (2) Of the positions announced, about 40 percent of the positions in mathematics departments and 35 percent of the positions in departments or schools of education were unfilled for the 2002–2003 academic year. (3) About one-third of the new hires that were made resulted from a faculty member moving from one institution to another. (4) Salaries for assistant professors ranged from $30,000 to $70,000, but the most frequent salary was between $40,000 and $50,000.

The above findings are consistent with the current supply line of new doctorates in mathematics education. Typically, there are less than 100 new graduates in the United States each year with a doctorate in mathematics education. Research suggests that due to other job opportunities, only about one-half of these new graduates seek new positions in higher education in the United States. One new finding from this survey is the number (about one-third) of mathematics education faculty that changed institutions. That is, they had a mathematics education position in one institution but applied for and accepted a similar position in a different institution. While this represented a hire for one institution, it created a new position for another institution and likely means that institution will be short a faculty member for the next year while they conduct a search.

The job opportunities for doctorates in mathematics education (whether new graduates or faculty interested in changing positions) are great. The projected openings for doctorates in mathematics education for the 2003–2004 [academic year] will continue to exceed the number of new doctorates entering the profession.

These results can be viewed as good news for folks with doctorates in mathematics education who are looking for jobs and chilling news for institutions that are competing for these people. One bit of good news on the horizon is that the Centers for Teaching and Learning being supported by the National Science Foundation are getting established, and if successful, several of these centers will be significantly increasing the number of new doctorates in mathematics education. In the meantime, I hope the mathematics community will continue to alert graduate students in mathematics to the opportunities available for those interested in pursuing careers in mathematics education.

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The *Notices* invites readers to submit letters and opinion pieces on topics related to mathematics. Electronic submissions are preferred (notices-letters@ams.org; see the masthead for postal mail addresses. Opinion pieces are usually one printed page in length (about 800 words). Letters are normally less than one page long, and shorter letters are preferred.