

Head Lines – Training the Next Generation of Science Teachers

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Our educational programs at both the graduate and undergraduate levels comprise a central focus of our department. Readers of this newsletter, and the larger university community, are well aware that we have expended great efforts in continual improvement of our teaching across the board. But because education includes such a broad array of activities, we have always considered our classroom teaching to be just one of many contributions we make to the educational enterprise.

One of these other contributions is a significant new departmental undertaking. Last year we, in collaboration with three other departments in the College of Science, branched out into an exciting new venture that has important consequences for us all. At that time we brought on board Prof. Ingrid Novodvorsky as one of three new College of Science faculty participating in the new Science Teacher Preparation Initiative (*Physics Matters*, Fall 1999). This is a College-wide program with a twofold purpose: to train future high school science teachers, and to conduct research on physics education, primarily (but not exclusively) at the secondary level.

As Mark Twain might have said (although he would have said it better), everyone complains about the “crisis” in high school science education in the US, but nobody does anything about it. Well, not quite. In fact, more and more science departments in universities around the country *have* started to do something. Some, like the Physics Department at the University of Washington (among others) have established strong groups committed to research in physics education. Topics under study include how students build mental models of the world, how and why these models often conflict — and remain resistant — to teachers’ efforts to impart a modern scientific world view, how to develop workable new approaches and techniques to physics teaching, and how to effectively — and realistically — assess what has been learned. Ultimately, the aim is to understand how students learn science (a subject on which our understanding is at least as murky as for any other forefront topic of physics research), and how to teach it. That’s an ambitious program, and requires research as innovative and difficult as that required in any other cutting-edge area.

Here at the University of Arizona, the Physics Department has long been heavily involved in outreach and collaboration with local high schools. But there is no question that the Teacher Preparation Program represents an intensive new effort in this arena, and a

major new commitment. In undertaking this endeavor, we are responding to a recent joint statement by the American Physical Society, the American Association of Physics Teachers, and the American Institute of Physics on the education of future teachers. In their statement, they “urge the physics community, specifically physical science and engineering departments and their faculty members, to take an active role in improving the pre-service training of K-12 physics/science teachers”. The intersociety statement goes on to call for “increased educational research to determine effective science, mathematics, and technology education teaching strategies and how students learn”.

It is not my intention here to repeat the litany of problems in attracting and retaining excellent science teachers at the K-12 levels, nor to sound the usual alarm bells regarding how American students compare to others in science and math capability. These problems and issues are undoubtedly well known to all readers of this newsletter. There are numerous studies, reports, blue-ribbon panels, and government commissions that have bombarded us all for years with data, recommendations, and blueprints for change. I will only quote briefly from the most recent of these, as of this writing. Just this month (September, 2000), the National Commission on Mathematics and Science Teaching for the 21st Century, chaired by John Glenn, issued a lengthy report to the Secretary of Education. They note that it is no longer enough for teachers to learn how to teach — they must also be “steeped in their disciplines and ... have the professional training — *as teachers* — to teach those subjects well” (italics in original). They go on to note that teacher training is no longer “simply a matter of preparation; it depends just as much — or even more — on sustained, high-quality professional development”. Tellingly, they note that — in contrast to several other countries with whom we compete in the global economy — “the basic teaching style in too many mathematics and science classes today remains essentially what it was two generations ago”. (As a parent, though, I must add that given some of the innovations I’ve seen, this is not always a bad thing.)

The Science Teacher Preparation Initiative seems almost like it was designed as a response to these challenges — except that its initiation preceded them. Traditionally, future high school teachers were trained in Colleges of Education, here and elsewhere, and many still are. It is relatively new for Colleges of Science to take an initiative in this area, but if we don’t take the responsibility for both the future of our profession, and for society’s understanding of what we do, who will? Our program is designed to merge the training of teachers with the training of future scientists — into single individuals who will know their science and know how to teach it. It’s an exciting idea whose time has come — if it’s not long overdue.

So, although we have very little by way of past experience to guide us, we’re embarking on this new path with great excitement and enthusiasm. We don’t know how it will all turn out, but, as with any new project, that’s at least half the fun of it. I think we’ve already made a great start, both in enlisting the very best people to spearhead the new effort, and in constructing a physical space in which it can happen. If you haven’t seen it yet, stop by the renovated area in PAS 170, which is now the Physics Education Research Laboratory, and take a look around. (Guided tours can also be arranged if desired.) And just last month our program (or, more accurately, an activity connected to it) shared in a

national award from the U.S. Department of Education. The Modeling Instruction Program, administered at both ASU and UA, was named one of seven K-12 educational technology programs designated as exemplary or promising, out of 134 programs submitted to the agency last year. Prof. Novodvorsky, who has served as co-coordinator (with Prof. J.D. Garcia) of the UA's Modeling Instruction Program, accepted the award on behalf of ASU and the UA at the Department of Education Secretary's Conference on Educational Technology in Washington, D.C., on September 11.

Not bad for a fledgling effort.

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