Training Mathematicians to Teach Mathematics In Mexico

(*Alejandro R. Garciadiego*—) The shortage of trained mathematics teachers is so acute in Mexico that almost all students receive their mathematical education from non-mathematicians. This condition even extends into undergraduate programs: if there is a need for an economics student to learn mathematics, then an economist will teach him or her, and the same is true for architecture, engineering, medicine, and so on. It seems that only mathematics students are trained by professional mathematicians at the undergraduate level, and the situation is even worse at earlier levels of education. At the mathematics department of the Faculty of Sciences of the Mexican National University (UNAM), mathematicians have been working on these problems at several different levels of pedagogy and a variety of viewpoints are present.

One group of mathematically trained pedagogues have concentrated their efforts on the better teaching of mathematics at the primary and secondary levels by lecturing the primary and secondary teachers, and teachers in technical programs, on developments in mathematics (such as theory of sets or mathematical logic) and providing instruction in higher or more advanced topics (such as abstract algebra, differential equations, or topology). In this approach the students remain once removed from the mathematician. Moreover, although better mathematical training for

teachers is desirable, some pedagogues challenge the need for teachers with very high qualifications in advanced mathematics. Is it necessary to know functional analysis to lecture on factorization, trigonometry, linear equations, or plane geometry? These critics would claim that it is better to have a deeper acquaintance with elementary mathematics.

Another major mistake in the teaching of mathematics, many of these same pedagogues would say, is the extreme formalism nowadays in vogue. Students are learning too much axiomatics, they claim, and not acquiring the skills *to do* mathematics. That is to say, the students are not being prepared to solve mathematical problems. Here they suggest that the rôle of the history of mathematics is fundamental for the better teaching of the different mathematical disciplines. The use of historical examples might be useful to show how mathematics has benefited from practical problems, how concepts are created and modified, and how a mathematical branch evolves and transforms. The adoption of historical problems might help the students to be critical towards the ways mathematical knowledge is taught and introduced.

There is also the complaint that often mathematicians are not prepared to teach. Mathematicians, in general, simply repeat what they have learned—sometimes exacty in the same order and with the same examples as used in their training—without attempting to improve the didactical process. If most students of mathematics teach, why are they not instructed in pedagogy? There are subjects that might enrich the whole mechanism of didactics, such as psychology of the process of teaching and learning, didactical resources, and the like.

As teachers of mathematics at any level, we must consider the objectives or purposes of each course. What do we expect the student to learn and, most important, why? Having found these answers, we then need to ask how best to accomplish our goals. There is not one single simple solution to this complex question, but surely a better way to proceed would consist in a balance among better training in elementary mathematics, less formalism with more historical material, and instruction in the principles of pedagogy. *[Alejandro*

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