

MATHEMATICS IN LATIN AMERICA AND THE CARIBBEAN

In order to know the most urgent needs and possibilities for the development of mathematics in countries represented in the International Mathematical Union, a meeting named Mathematics in Emerging Nations: Achievements and Opportunities (MENAO) was held on 08/12/2014 just before the International Congress of Mathematicians in South Korea, to which, through a program named NANUM 2014, the Korean organizers invited 1000 mathematicians from the developing world to attend. NANUM is a Korean word that means gracious and unconditional sharing. MENAO was a proper occasion to hear about the needs of the developing countries to enhance their mathematical activities and the projects they would like to put forward for that purpose.

A report on the mathematical development in Latin America and the Caribbean, prepared by the authors of this editorial, was presented on that meeting (IMU CDC Report - Mathematics in Latin America and the Caribbean, available at www.mathunion.org/fileadmin/CDC/cdc-uploads/CDC_MENAO/Mathematics_in_Latin_America_and_the_Caribbean_Report.pdf, and a summary in www.ams.org/notices/201409/rnoti-pl052.pdf).

The report stressed the big differences between the countries of the region and also some similarities. In general, there is a severe shortage of human and financial resources, excruciating burdens of government incompetence and lack of interest in scientific development but there are also some success stories. The average performance in the mathematical Olympiads has been improving; there are strong mathematical research centers; scientific production shows Latin America as the zone of the planet with highest growth; UMALCA, an organization of mathematical societies of Latin America and the Caribbean, supports regional schools and promotes collaboration among mathematicians of the region. In short, there are reasons to be optimistic, but building a better future requires concerted actions of mathematicians and organizations (regional and global) to develop the full potential of mathematics in this region.

A study of the number of mathematical publications per million inhabitants in the countries of the region shows that Chile leads, followed by Uruguay, Argentina, Puerto Rico, Brazil and Mexico, with a large variability in productivity. The efficiency of the mathematical production of Chile is ~1450 times that of Nicaragua, and that of Venezuela, a country now in the top 25 % is ~123 times that of Honduras, in the top 75%.

Mexico, Brazil, Argentina, and Chile have large centers of mathematical research but also a large variability in the

mathematical level within each country. They could serve as a regional resource and model for mathematical development. The situation in Central America is different: a population of $>40 \times 10^6$ people has no access to a local Ph.D. program in mathematics. There is such a program in Puerto Rico that could serve as a common resource. The Caribbean has the largest variability in terms of language and geography and it is worth noting that communication among the islands has been facilitated by the mathematical Olympiads.

Within the 147 most scientifically productive countries in the world from January 2000 to August 2010, the Iberoamerican countries included among the top twenty were Spain (ranked 9) and Brazil (15). In that same period, Mexico was ranked 28, Portugal 34 and Argentina 35.

The scientific productivity of most of the Latin American countries, between the late 70s and the late 80s remained almost constant. From the mid-1990s, most of the nations of the region began increasing their productivity again.

Portugal has the highest growth constant of the sample. Within a period of 38 years, it increased its publications per million people 64 times. This dramatic change, due in part to political changes (e.g., entering the European Union in 1986), shows that with the appropriate environment, countries in the LAC region could experience an acceleration of their research productivity. Specifically, the growth of mathematical production in the LAC region has doubled in the span of eight years (1999 to 2007) according to the SCImago database. There is no other region of the world with this rate of growth in this time period.

The case of Venezuela is most worrisome, with its productivity dropping during the past years and being surpassed in mathematical production by Colombia. Political unrest, a deepening economic crisis and a resulting alarming migration of university professors may account for this.

With a better use of the region's financial and human resources and the help of more developed countries, some strategic actions could have an important effect on the development of mathematics in the region. Activities of relatively low cost such as the expansion of UMALCA's programs, and the program of mathematical competitions for young students, together with training for students and teachers, may help this development and sustainability.

LUIS CÁCERES, CARLOS DI PRISCO, JOSÉ ANTONIO DE LA PEÑA,
ÁNGEL PINEDA Y ANDREA SOLOTAR