

Enrique Zuazua, mathematician

“Without mathematics there would be no civilization: it is the language that sustains the world”

María Arana

At 65, the Basque mathematician Enrique Zuazua looks back on an international career marked by research, teaching, and science management, while keeping a clear mission: to pass on his passion for a discipline he considers essential for understanding the present and building the future. He is a full professor at the Faculty of Science and Technology of the University of the Basque Country (UPV/EHU); a member of the Academia Europaea; and director of the Basque Center for Applied Mathematics (BCAM). He also chairs the Deusto Foundation and is an honorary fellow of Alexander von Humboldt.

—You recently received a tribute from the international scientific community. What does this recognition mean to you?

—It has been a very special experience. I owe it to the place where I was born and grew up, the support of my family, and to so many people who have accompanied me throughout my career. I coincide with colleagues from different stages of my life—researchers, collaborators, young students—all of whom in one way or another have played very relevant roles in my work. It was an emotional and moving moment to see so many people from around the world gathered from a professional perspective.

—Is there a message you would like to share when thinking about your legacy?

—In short, retirement is a life concept. There are, of course, administrative aspects, but what matters are the people around us and the privilege of continuing to do what we love. In my case, that does not disappear when you reach a certain age. Many researchers remain closely linked to the university community and scientific projects, not only in their own country but also abroad. Mathematics still forms a central part of who I am.

—Moreover, all this comes at a time when there is exceptional enthusiasm for science.

—We are living through a transformation comparable to



Enrique Zuazua, full professor at the University of the Basque Country and director of BCAM.

the introduction of the printing press or the internet. Artificial Intelligence is bringing tools with enormous potential to accelerate scientific and technological development across fields such as medicine, health, climate science, and extreme events, social sciences, or industry. It is a transversal phenomenon.

—Yet you often stress that AI also raises major challenges.

—What worries me most is the risk of not developing tools rigorously, or of not controlling their use so that they serve people. To do this, we must educate not only digital specialists, but all citizens. Artificial Intelligence demands a fundamentally human response. We need sound ethical criteria, the ability to understand how these mechanisms work, and a genuine interest in generating answers that take human values into account.

—Is intelligence the most important feature of AI?

—It is certainly one of the great questions of our time. We tend to believe that these systems can do things that seemed unimaginable just a few years ago. However, understanding how they work, what they can and cannot do, and their limits remains fascinating. These advances are impressive, but they also raise very important questions, related to social impact, education, or scientific progress.

Ultimately, the human being is still unique for qualities such as creativity, fundamental ethical principles, the ability to question, and social intelligence. Mathematics plays a key role in promising areas such as extraordinary communication, and it has already enabled advances in health, education and society. Mathematics has helped us to see reality in a new way and to address the climate crisis, for example, by designing the simulations and models needed to understand and tackle complex phenomena in an interdisciplinary way.

—When did you discover that mathematics would be a central part of your life?

—Very early. I remember perfectly being in the first year of secondary school in Eibar. It was a different time. The classes were more rigorous, and I wanted to understand how the system worked — how everything fit together. That curiosity led me to study many extra problems. Later I studied at La Salle de Eibar and, afterwards, at the University of the Basque Country. But it was at university where I really discovered mathematics and felt that I was finally in the right place.

—How do you assess mathematics education today?

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—You have said on several occasions that mathematics is an indicator of a country's development. Why?

—Countries that invest more in mathematics and other fundamental sciences tend to make greater progress economically, technologically and socially. In my case, the training I received in the Basque Country allowed me to develop research and to take risks. I was able to carry out



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postdoctoral research abroad without difficulty, which later enriched my academic career. This is also a clear indicator of development.

—How do you assess mathematics education today?

—I believe it has improved significantly compared with fifteen or twenty years ago, thanks in part to the influence of data science and Artificial Intelligence. Today, many students encounter applied mathematics in fields such as biology, computer science, finance, banking, consulting, or technology companies.

—If you could choose a symbol that represents this science, what would it be?

—Perhaps a Gaussian curve. Its extraordinary contributions have opened up many fields of knowledge. But I would also mention Euler, Leibniz, Newton or Pythagoras. Their work illuminates the beauty and depth of mathematics, which occupies a special place in human history.

—What makes mathematics unique compared with other disciplines?

—Because it is a universal language. We have hundreds of different languages in the world, but only one mathematical language. It is universal because it underlies science and engineering. All disciplines rely on it. So, mathematics is not just a discipline, but also the language that unites knowledge and has played a fundamental role in history.

—Although you have developed most of your work in Germany, do you miss your roots?

—Of course. I am from Eibar and I continue to feel a strong connection to my origins. I studied there, grew up there, built friendships, and I have always maintained close ties with its social and professional fabric, as well as with the University of the Basque Country.



“Mathematics is what allows us to open the black box of Artificial Intelligence models and understand what mechanisms are operating inside”