

Cibercoloquio Latinoamericano de Matemáticas

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The *Cibercoloquio Latinoamericano de Matemáticas* is an online colloquium for the global Spanish-speaking mathematical community that began during the COVID-19 pandemic. Since June 5, 2020, every Friday we have featured a one-hour talk in Spanish given by a distinguished Latin American mathematician followed by a question and discussion session. The style of the talks is similar to departmental colloquia, where the speaker presents an aspect of their research to a general mathematical audience, aiming to keep most of the content accessible to advanced undergraduate students. The initiative has had an overwhelmingly positive response from the Latin American mathematical community with more than 2500 registered

participants from more than twenty countries. In this note we share how the initiative was born, how it works, and some lessons learned thus far. We discuss future plans, and invite Spanish-speaking mathematicians and students in the United States (US) to join our global community.

1. Motivation and First Steps

The impact of the COVID-19 pandemic has been particularly disruptive to the academic world, where in-person group meetings have always been essential for both teaching and research. In a short period of time, we have completely redesigned the way our main academic activities are performed. These developments have had both positive and negative consequences: many inequities and privileges have been revealed and amplified; hundreds of events have been made public and accessible to broad audiences; we have gained awareness of many necessities and challenges of our research communities; and we have learned about novel ways of using existing technology to communicate and share mathematics. This is the context that inspired us to organize the *Cibercoloquio Latinoamericano de Matemáticas*.

The idea for the initiative came about after various informal discussions we had during the quarantine period regarding the effect of the pandemic on the Latin American mathematical community. We are all early-stage mathematicians that began their mathematical training in different parts of Latin America. We found that our paths, experiences, and careers, as well as our approach to

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DOI: <https://doi.org/10.1090/noti2270>

mathematics, have strong similarities. For instance, most of us never had the chance to learn about certain research areas of modern-day mathematics before leaving our countries. We also greatly enjoy interacting, learning, and collaborating with Spanish-speaking colleagues with whom we share cultural affinity; in fact, many of us have felt that under these conditions the exchange of mathematical ideas flows in a particularly effective way.

We decided to take advantage of the situation, now that everyone is spending most of their time online, to organize a large-scale event where the Latin American mathematical community could meet periodically to hear about a research topic presented *in Spanish*, in a way accessible to a wide mathematical audience, by a renowned expert from the community. We also thought that an event of this nature could help in mitigating some of the challenges that the community faces.

2. The Latin American Mathematical Community

By the *Latin American mathematical community* we mean, very broadly, the global community of mathematicians that have origins in Latin America. This includes students, researchers, and professors based in the region as well as outside the region. This term also includes Hispanic and Latinx mathematicians in the US who culturally identify as Latin American.

Spanish is the most spoken language in the Latin American mathematical community. Even more, it is the second most-spoken native language in the world, after Mandarin Chinese, with over 483 million native speakers [4]. It is the official language of twenty countries—nineteen of which are in the Americas—and is the second most spoken language in the US, with over 38 million Americans speaking Spanish at home. If we include Portuguese, the second most-spoken language in Latin America, the number of native speakers is over 700 million.

Latin America is a fast-growing region in terms of mathematical activity and research. Mathematical production doubled in the lapse of eight years between 1999 and 2007 [2] and more recently many countries have shown an impressive increase in the number of published articles as indexed by MathSciNet.

The international influence of the Latin American mathematical community has been particularly notable in the last decade. There are Latin American mathematicians leading cutting-edge research programs in institutions all over the world. Many of them have been recognized internationally for their work with invitations to plenary talks at conferences such as the International Congress of Mathematicians (ICM) and winning prestigious prizes such as

the Fields Medal (Artur Ávila, 2014). Plenty of international research conferences and mathematical events are organized every year in different cities of Latin America. In the US, new organizations and initiatives have been formed to give visibility to the work of Hispanic and Latinx mathematicians, including Lathisms [1] and SACNAS, among many others.

However, the mathematical community in Latin America still faces many challenges, most of them of socio-economic nature and, as a consequence, mathematical events, talks, and meetings are often not accessible to certain groups and even to entire countries. In particular, there is a large number of students who rarely have the opportunity to discover different fields of modern research, let alone have any kind of contact with world-renowned experts. The region is well known for its high inequality indicators and many countries, including those who have a strong mathematical tradition, are usually heavily centralized leaving a vast amount of territories without the basic resources for high-quality mathematics research. See, for example, [2], pp. 20–41.

Even with the existing technology and online resources, it is often difficult to find material accessible to students who are starting to navigate the complexity of contemporary mathematics (e.g., mathematics students at the advanced undergraduate level). Furthermore, most of the accessible material tends to be written in English, which poses a major hurdle for a significant proportion of the student body. According to the EF English Proficiency Index [3], Latin America has an English proficiency level below the world average in all age groups, especially in the 18–20 age group [5]. We therefore thought it would be a good idea to host our event in Spanish and eliminate this language barrier.

In the US, the Hispanic community faces the challenge of underrepresentation in the mathematical sciences and in higher education in general. For example, in 2018 according to census numbers, 18.3 percent of the US population were Hispanic [7]. However, only 3.98 percent of 2018 PhDs in mathematics were Hispanic [6]. Of course, this is a complex and subtle issue that also has deep roots in socio-economic and systemic factors and has been largely documented, studied, and discussed in various forums of different institutions and organizations, including the American Mathematical Society.

With all of this in mind, we determined that the Cibercoloquio would have the following three main objectives:

1. Celebrate the careers and mathematical achievements of some of the most outstanding mathematicians of the Latin American mathematical community.

2. Expose the Latin American mathematical community to a wide variety of modern research areas through high quality, clearly presented, colloquium-style talks that are accessible to anyone with a good grasp of basic undergraduate mathematics, but are also interesting to researchers.
3. Promote the interaction between different groups in the Latin American mathematical community and create awareness about existing opportunities for higher education and collaborations that could lead to strengthening the community.

3. Inviting Speakers

In order to meet the objectives mentioned in the previous section, we consider the following criteria when inviting speakers:

1. *Mathematical excellence.* The Latin American mathematical community includes strong research groups and researchers who have been greatly influential in their fields. We aim for this excellence in research to be reflected in our speaker list and for each talk to be given by a leading expert in the topic presented.
2. *Exposition.* We aim for talks to be of high quality, not only in terms of mathematical content, but also clearly presented and accessible to a broad mathematical audience. To achieve this, we carefully identified possible speakers who were also known for the quality of their exposition. The initial speakers set a standard, and, in some sense, defined the style for the subsequent talks of the Cibercoloquio.
3. *Diversity.* Latin American mathematics is as diverse as Latin America itself and we strive to reflect this in the Cibercoloquio. Diversity here is meant in a very broad sense. We aim for the speaker list to be balanced in terms of gender, to feature mathematicians from different countries and backgrounds, to include researchers based in institutions in Latin America and also outside the region, and for a wide variety of research areas to be represented.

With this in mind, we invited the initial set of speakers for the first month of talks:

- Federico Ardila (San Francisco State University and Universidad de Los Andes, Colombia)
- Carolina Araujo (IMPA, Brazil)
- Mariel Vázquez (UC Davis)
- Gunther Uhlmann (University of Washington)

For the first talks, we invited researchers that were already well known in the community. For the subsequent talks, we tried to keep a balance between young talented mathematicians and more experienced established researchers.

4. El Cibercoloquio and its Future

The first meeting of the Cibercoloquio took place on June 5, 2020, with Federico Ardila speaking on *Geometría CAT(0), robots, y sociedad* (CAT(0) geometry, robots, and society). The talk had over 350 live attendants, and since then the YouTube video has had over 1000 views. We continued the following weeks with talks from other high-profile mathematicians that quickly established a name for the event.

Many mathematical societies and departments all over the world have advertised our event and our social networks have grown rapidly. At the time of this writing, we have had 28 talks in a wide variety of topics both in pure and applied math. All of these talks have been successful and highly attended. More than 2500 participants from over twenty countries have registered in the event's email list. The YouTube channel "Cibercoloquio Latinoamericano de Matemáticas" has over 750 subscribers. During the first few weeks of the Cibercoloquio, each talk averaged well over 300 live viewers. Attendance has gone down after these first few talks, we believe partly due to semesters starting in different departments and the so-called "Zoom fatigue." Still, each weekly talk averages more than 150 live viewers, and usually the YouTube video reaches 400 views within a week of the talk.

The format for each talk is similar to a webinar. Each talk is transmitted via Zoom and YouTube. The participants who are registered receive a Zoom link the night before the event, while the YouTube live streaming is public. Participants in Zoom are muted, but can send questions and comments to the organizers, who then ask them out loud directly to the speaker. We also receive questions in the YouTube chat and ask some to the speaker. In general, it can be complicated to allow direct participation with such a large audience, but we have tried to be flexible. For example, in contrast to other webinar talks, we have allowed certain participants to unmute themselves and ask their questions directly. We have also done this several times with comments and questions from experts in the speaker's field who are in the audience.

We have been able to create a particularly warm and relaxed atmosphere that encourages participation. For example, we open the session ten minutes earlier while the participants log on. During this period, we welcome the participants directly through the chat, we ask them to tell us where they are based, and we play music from the speaker's country of origin. We ask each speaker to give a one-hour talk but we tend to be very flexible with the time; similarly, we do not impose a strict time restriction for the question session, many of which have extended for longer than thirty minutes. We have had questions and comments of every level and style, including discussions that could lead

to research collaborations. All of this, together with having the talks in our native language, has created an atmosphere where attendees feel comfortable participating and, we believe, it has had a positive effect in the way the participants digest the mathematics being presented.

The Cibercoloquio started as an attempt to mitigate the effects of the pandemic and has evolved into a successful and popular event that will continue long after the health crisis is over. At this point, we have decided that starting in February 2021 the event might be held on a less regular basis, either monthly or biweekly. The event will keep the same style and format. Now that the event enjoys some more recognition, we intend to feature younger mathematicians who have already done interesting and important work. Our YouTube channel is becoming an interesting repository to learn about recent trends in mathematics.

Recently, we have started reaching to the Portuguese speaking community, featuring talks in their language and translating the webpage. Brazilian mathematicians Umberto Hryniewicz and Emanuel Carneiro were the first ones, and we plan to have more in the future. Brazil has a large, active, and vibrant mathematical community with close ties to the rest of Latin America. We hope that this effort will help bring together mathematicians from both communities.

We would also like to increase the participation of the Hispanic and Latinx mathematical community in the US both in terms of attendees and speakers. We recently featured Pamela Harris (Williams College) who is a strong voice in the community. We feel that there is much to be gained from increasing connections between the Hispanic and Latinx mathematical communities in the US and the community based in Latin America.

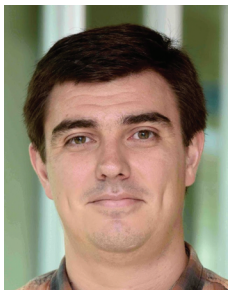
Furthermore, we are considering complementing the event with other special topics, including career advice and opportunities. A large portion of our participants are students who might benefit from sessions about applying to graduate schools, research opportunities, and about finding jobs in mathematics both inside and outside academia. We are open to suggestions.

We are thankful to the amazing pool of mathematicians that accepted the invitation to present their work in the Cibercoloquio and to the participants that have enthusiastically participated in the talks. They have made this event a truly special and unique one. We are also grateful to Purdue University, Universidad de Costa Rica, and University of California, Davis for providing the necessary infrastructure for the Cibercoloquio to take place.

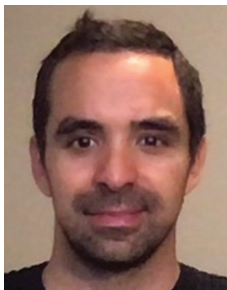
We invite the Spanish-speaking mathematical community in the US to participate, suggest speakers, and comment about ideas that may enhance or improve the event. More information, including the announcements of future talks, links to videos of past talks, our email list registration form, and the organizers' contact information, may be found on our website: www.cibercoloquio.com.

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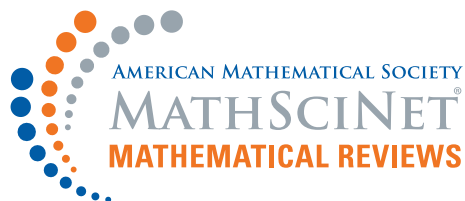
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