

content of the conference to those occupied with childcare or other commitments. Be very clear and upfront with speakers and other presenters about whether events will be recorded and how the videos will be handled. Some speakers prefer not to be recorded; at WAGON we were largely able to ameliorate these concerns by providing the option to record talks and post them only temporarily (say, for three months after the conference).

Keep in mind the possibility of making the videos available only to the registered participants or making them password protected. Zoom provides the option to record the lectures on either the cloud or your local computer.

2.7. Reflections on the Future

We hope that this document can provide a starting point for a community-wide discussion of best practices in online conferences. While we are certain that online events can (and will) never replace in-person meetings, we also hope that the lessons learned here will be useful post-COVID. The real benefits of the online format should not be overlooked—especially its ability to include those who might otherwise not be able to attend in-person conferences. The fight against climate change may require some proportion of conferences going forward to be held virtually. One takeaway from WAGON was the real need in the mathematical community to actively participate in virtual conferences now, even if they are an imperfect substitute for in-person conferences.



Jarod Alper



Daniel Litt



Isabel Vogt

Credits

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How Do I...Develop an Online Research Seminar?

Henry Adams

Developing an online research seminar requires work, trial and error, and the willingness to experiment with something new. There are multiple benefits to running a research seminar online:

- an online seminar is accessible to a more diverse audience across the globe, especially if some of the seminars are recorded and made publicly available;
- an online seminar is a cost-effective way to share research ideas without negatively impacting climate change; and
- an online seminar brings together members of a community who otherwise might not interact.

Due to the COVID-19 pandemic, in early 2020 it became necessary to run a research seminar online if one wanted to run a seminar at all. Out of necessity, mathematicians will be gaining more experience with communicating online. Though some benefits of online seminars are clear during a time of social distancing, we emphasize that other benefits are lessened: accessibility of an online seminar is not shared equally during a global pandemic, perhaps not by those in a caretaking role, not by those taking on additional jobs, not by those volunteering to serve, and not by those without consistent access to the internet.

This article is divided into three sections: my tips for running an online research seminar, a description of the Applied Algebraic Topology Research Network (AATRN) seminar that Sara Kalisnik and I codirect, and links to other online seminars and resources.

1. How Does One Run an Online Research Seminar?

Here are my tips for running an online research seminar.

Host an interactive seminar that audience members can join live. Many audience members prefer to watch a live talk in which they can unmute themselves and interrupt the speaker with a question. Those without a microphone can also type questions into a chat window; it is your job as the moderator to ask these questions aloud to the speaker (who may not otherwise see them).

Post recorded seminar videos publicly. If the speaker gives you permission, it is a good idea to record the talk and post it online. Every platform for hosting videos has its own pros and cons, but two advantages of YouTube are:

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- YouTube videos are easy to find and hence your viewership will increase, and
- YouTube automatically tracks viewership statistics.

The AATRN seminar, for example, has over 1,000 YouTube subscribers, over 150 hour-long videos, and over 12 hours watched per day. Recorded videos improve accessibility for those whose time zones are incompatible with the time of the live seminar, as much of your videos' viewership will not be from your country.

Give the speaker instructions. Meet with each speaker the week before their talk in the videoconferencing service you're using. A week provides time to find solutions if technical difficulties arise. Have the speaker share their screen—slide talks or tablet talks work the best, unless the speaker has a camera they know is good enough to capture a chalkboard or whiteboard. For slide talks, tell the speaker that we can see their cursor, and hence they can use it as a pointer on occasion. Tell the speaker they have (say) fifty minutes, with time for questions at the end. Ask the speaker if you have their permission to record the talk and post it online, and make sure you know how to pronounce their name correctly! An important aspect of this meeting is seeing if the speaker's wifi connection is stable.

Give the audience instructions. Immediately prior to each talk, my codirector or I say the following:

Welcome everybody; thank you for joining our online seminar today. Upon entering you are all automatically set to be muted, but please unmute yourself to ask a question. Alternatively, if you don't have a microphone, you can type a question in the chat window which I will then read aloud to the speaker. Without further ado, let me start the recording and then I'll introduce our speaker! [Start recording.] It is my pleasure to introduce Jane Doe, from Sacramento State University, who today will tell us about Estimating Fractal Dimensions.

At the end of the talk, I ask all audience members to unmute themselves to clap for the speaker. I then ask for further questions, before stopping the recording and saying goodbye.

Interrupt the speaker every fifteen minutes. If you have ever given an online talk, then you know how uncomfortable it is to feel like you are talking to yourself for an hour! I warn speakers that they should expect this awkwardness, and that it is normal. I try to combat this feeling with periodic questions, so that the speaker knows the audience is still present. If fifteen minutes pass and nobody has asked a question, I will interrupt to ask a clarifying question (whether I have a burning question or not).

Find a committed audience. For the first semester of your seminar, find a committed base of 5–10 people who will attend the majority of the talks. Until you know your audience better, it is comforting to have a lower bound on the number of attendees. Is your audience a targeted group

of experts, or a broad group including students and faculty from related areas?

Do your best to build community. Building community online is not easy and takes persistence. Clapping at the end of each talk helps—audience members are very appreciative of the work the speaker has put in to give an online talk. It is fantastic if a group of folks log in together from a videoconferencing room at their home institution.

Are themes appropriate for your seminar as a way to build continuity? The VaNTAGe virtual seminar² is focused on open conjectures in number theory, and has been organizing 4–5 talks on each conjecture.

Technical issues will arise, but you will outgrow your fear of them. Your biggest worry at first will likely be regarding technical difficulties. Eventually, that worry will dissipate: you will have moderated enough online seminar talks to give you the confidence that even if this present talk gets disrupted, your audience will forgive you. Consider arranging a way to contact the speaker should technical difficulties arise on the day of the talk. The most frequent issue I see is that the speaker's wifi connection is not stable (a videoconferencing test with the speaker the week before helps). In this case, ask all audience members to turn off their video. Once for the AATRN seminar, a speaker (understandably) arrived an hour late to their talk since their country did not practice daylight saving time. I waited for ten minutes before canceling that day's talk and rescheduling it, and I now communicate time zones with more care around daylight saving transitions. Taking turns moderating talks with a friend helps; if they're in the audience, they can step in as moderator should any difficulties arise on your end. At most one in every ten talks will be partially disrupted by technical issues, and when this happens your audience will understand.

Think about inclusivity. A regular meeting time is helpful for building an audience and community, but adjust that meeting time for speakers whose time zone is incompatible. We are proud that the AATRN seminar has recruited speakers who were not yet part of the applied topology community, and that gender representation has improved at our seminar over the last few years. We would like to do a better job of promoting diversity along other axes. For example, YouTube has tools available for closed captioning (creating subtitles), though we have not yet experimented with these. Recently, we have increased our audience by hosting not only cutting-edge research talks, but also introductory tutorials.

2. The AATRN Seminar

I'd like to share the story of only one online seminar, the one I know best. How did the Applied Algebraic Topology Research Network (AATRN) seminar³ come to be?

²<https://sites.google.com/view/vantageseminar>

³The homepage for the AATRN seminar is available at <https://topology.ima.umn.edu/seminars>, and our YouTube channel is linked within.

In 2013–2014, the Institute for Mathematics and its Applications (IMA) hosted a thematic year on Science and Engineering Applications of Algebraic Topology. Near the end of this successful thematic year, then-IMA director Fadil Santosa had the good idea to maintain the community online. AATRN founding director Peter Bubenik created and led the network, with the help of community volunteers and IMA staff. The live online seminar became AATRN’s flagship program, with twenty-one talks in its first academic year, 2014–2015. The seminar benefited greatly from having an audience base of thematic year attendees.

In 2017, a year after I joined as AATRN codirector, it became fiscally unwise for the IMA to fund our \$100-per-month WebEx videoconferencing license. We moved all of our publicly available videos from the WebEx website to YouTube. Posting our videos to YouTube accidentally led to a revival for our seminar. Before the transition to YouTube, I was concerned about the size of our live audience, which had been decreasing since the energetic first year. I questioned if my time running the seminar was well spent. However, I was heartened after the number of hours watched on YouTube quickly exceeded those by live attendees, and the number of YouTube subscribers quickly exceeded the number of AATRN email list members. I now justify the time that I spend on the AATRN seminar not based on the live interactive audience, but based on the viewership for our recorded videos. We have also helped in-person conferences record their talks or post them to YouTube, and we invite conference organizers to contact us if they are interested in doing this.

The main cost of an online seminar is the videoconferencing license, along with the time volunteered by its organizers. AATRN currently survives without a budget or funding, but with the gracious support of the IMA and Colorado State University. After stopping our WebEx account, we were fortunate to move to a Zoom videoconferencing license, which can host up to 1,000 audience members, made freely available to us by the Department of Mathematics at Colorado State University. We are fortunate to receive website support from the IMA and its staff. We have not blocked off time to apply for grants, but we predict that grant applications that fund online research seminars will be increasingly successful going forward, given new realities due to the COVID-19 pandemic. Ideally, additional funding beyond the cost of a videoconferencing license could allow an online seminar to fund a student to

- run the videoconferencing tests with the online speakers,
- post the recorded talks to YouTube,
- edit YouTube’s automatically generated subtitles, and
- make recordings of live talks at conferences they attend (with the speaker’s permission).

Another idea we would like to try with AATRN is to record talks over the summer by PhD students and postdocs

before they go on the job market, and to record short talks in the fall by undergraduate students before they apply to graduate schools.

3. Links

See <https://researchseminars.org/> for an incomplete but growing list of online mathematics seminars.

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Author photo is courtesy of Ewo Harrell Adams.

No Going Back, Only Going Digital

Chloe Urbanski Wawrzyniak

Entire industries are being flipped on their heads by the actions being taken to slow the spread of COVID-19, and higher education is certainly no exception. University administrators, departmental leadership, and individual instructors have had to answer complicated questions in a matter of days, all while learning new technologies and communicating remotely. I cannot put into words how humbled and impressed I am at the work of colleagues across the world and at every level of education to ensure that our students can keep learning in this time of crisis.

When the dust finally settles on this pandemic, that work will change the way we think and talk about education

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