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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Henry Adams

Credits

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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forever. This article is an invitation to step back from the chaos and reflect on all that we have learned in this process. There is no going back after an event like this. We can only go forward, and in large part, that means going digital.

Access to Technology

For many of us, the easiest way to move our face-to-face courses online was to live-stream our lectures using a videoconferencing platform. This is referred to as a "synchronous" online learning model. For more interactive classes, the same platforms could be used to facilitate discussions. Taking full advantage of these platforms, however, can require access to technology that many students may not have at home: a computer or laptop, reliable high-speed internet, and a camera/microphone for discussions.

Even if most students have access to these things, we have a responsibility to provide the same access to resources and discussion opportunities to everyone. Solutions could include providing phone numbers to call into the synchronous class meetings, recording the sessions for students to access later, and providing detailed lecture notes as PDFs on the learning management platforms. More flexible online course designs include opportunities for "asynchronous" participation: tasks that students complete on their own time rather than requiring logging in at a specified time. Examples of asynchronous activities include discussion boards and prerecorded videos with embedded quiz questions.

Technology provides many opportunities to enhance the learning in our face-to-face classes, but student access issues will still remain when we return to campus. When adding technology to your classes, be keenly aware of what students have access to, and wherever possible provide resources for students to obtain them at low or no cost. Most schools have an office that provides such resources to low-income students, and on-campus libraries and computer labs provide technological resources that students can access for work done outside of class.

Open Educational Resources

Open Educational Resources, or OER, refers to free online learning resources that you can use to enhance your classes. These include content resources such as OpenStax, Khan Academy, and MathIsPower4U, as well as graphing and computing tools such as Desmos and Wolfram Alpha. For online courses, these are invaluable resources, but all the benefits of OER will still remain when students return to campus.

For students traveling potentially long distances to go home, online resources can mean the difference between having access to the course materials and leaving them at school. In traditional face-to-face courses, the flexibility of online resources allows students to easily access the course materials from anywhere, opening up more opportunities for practice and study.

The rising cost of college is still a challenge for many of our students, and the cost of course materials only adds to that burden. Using free resources for class can ease the stress our students are facing and ensure that everyone has access to the materials, regardless of their ability to pay. Additionally, if you are already using other materials, providing links to OER sites gives students more options for additional practice and review.

Universal Design for Learning

Many of us have had students with accommodations for disabilities, most commonly extra time on exams. Although it is vitally important that these accommodations are still met in our online courses, I'm going to focus in this section on how these considerations can help everyone. This is a concept often referred to as Universal Design for Learning (UDL).

My favorite example of UDL is adding captions/subtitles to videos, which is becoming increasingly relevant in the online format. Any instructor who has a student with a hearing disability would be required to add captions to any assigned videos. Most universities, however, strongly encourage all instructors to include captions on every video because they can be beneficial to everyone. For example, English language learners already face many barriers in US universities, especially in lectures. Additionally, a student's environment can have an impact on their ability to listen to videos. Noisy study spaces, not having headphones, or needing to listen for a child or an elderly or sick family member can all make listening to videos challenging. Ensuring that your videos are captioned goes a long way towards supporting these students in being able to easily access the course content.

Your institution's disability services office will have resources on UDL. Use these resources to consider small changes in the course design, content delivery, and website that would increase accessibility for all students. Although we are all in extenuating circumstances now, we never know what might be going on in students' lives even when we get back to face-to-face instruction. Small adjustments on our part may go a long way towards leveling the playing field for all of our students.

Active Learning

A myriad of fantastic articles on the benefits of active learning already exists, so I won't rehash all of those points here. I do, however, want to highlight two benefits that are especially helpful in online classes: student feedback and interaction.

In a face-to-face course, we can see our students in the room with us, and we can see their body language and facial expressions. While this can sometimes be ambiguous or misleading, it can provide some feedback if something has gone horribly wrong or whether students have gotten distracted. In our online courses, we don't have that

benefit. Perhaps with a particularly small course, you can allow students to use their cameras, but even then, not every student will have one and not every student who has one will want to turn it on. Asking questions of your students throughout the lecture provides you with a sense of their attention and understanding. Most videoconferencing platforms have polling features, which prompt all students to reply to a multiple-choice question. This feature mimics the student response systems, sometimes called clickers, that many institutions already use in their face-to-face courses. These systems are gaining popularity for a reason. If you've enjoyed the feedback you get from polling your online classes, consider adding them to your face-to-face classes.

Online learning and online teaching can be incredibly lonely, especially with social distancing added on. Friends and colleagues are getting creative with virtual happy hours and synchronized movie watching.

Your students need this interaction as well in order to maintain engagement in the course. Turning on your camera while lecturing and using the polling features can already start to provide that engagement. More advanced features such as breakout rooms and group discussion boards provide students with even more opportunities to engage with each other in small settings and give you a chance to engage with them when you check in on the groups. These options can be easily recreated in a face-to-face setting by giving students problems to work on in groups during class time, or with more advanced activities such as jigsaw groups.

Assessment and Academic Integrity

Although instructors have access to digital tools that help to ensure the integrity of online exams, these just are not equipped to handle the scale of online assessment we are now seeing. Even in the tightly controlled environment of in-person exams, preventing students from using unauthorized help is quickly becoming an arms race. The increasingly ubiquitous nature of personal technology is only making that more challenging, and the move to online instruction has made it near-impossible to prevent academic integrity violations.

We can't possibly win the arms race in this environment, so disincentivizing academic dishonesty and rethinking how we assess students are our only options. For example, by having oral or other explanation-based components to the exams, instructors can get a better sense of student comprehension and make it more challenging to cheat. Other instructors are moving towards assigning longer projects rather than high-stakes tests. These give students an opportunity to try an interesting application, tie together topics in a course, or show their creativity and personality in how they demonstrate the knowledge they've gained.

Although we have more tools at our disposal for stopping cheating during in-person exams, the benefits of these more creative assessment options will remain. Consider a fresh approach to assessing your students that prevents academic dishonesty by the tasks it asks of students, rather than by the arrangement of the classroom and careful watch of proctors.

Maintaining a Digital Presence

In an online environment, your course website is now the face of the class. Whether it is on your personal website or through a Learning Management System (LMS) like Canvas or Blackboard, this is now the only way you can organize and present not only the course content but also the logistics of how the course will be run.

Online teaching techniques can be deployed in all kinds of shorter situations, such as when the weather makes traveling to campus dangerous or when you are away at a conference. These tools and skills that you have developed can be quickly implemented for a class meeting or two in order to provide continuity of learning, even when other forces make face-to-face instruction difficult or impossible. A robust digital presence for your course would be essential in making such a quick change happen successfully.

Even in a traditional fully face-to-face course, people are increasingly accessing the world through the internet. Young students, especially, view the internet as an integral part of life, rather than just a useful tool. These students will be looking online for resources and information. Maintaining a digital presence for your courses will help you to meet students where they are at.

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Credits

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