Hyperbolic space on the
Oculus Rift (Fall 2014)

Faculty mentor: Pierre Albin

An Electronic Seminar on Mathematics Education

Haynes Miller

On July 6, 2017, I had coffee with Grace Lyo in Kendall Square. She was once a postdoc at MIT, and was visiting from her current job at Stanford Online. We talked about our common desire to foster conversations about university level mathematics education, especially among people from research oriented universities. It seemed to us that there were a lot of creative innovations under way at many places, but it was hard to get much information about them. By chance, I had been following the "Electronic Computational Homotopy Theory Seminar," created just that spring by Dan Isaksen of Wayne State University using Zoom, a web conferencing application. It occurred to us that while local audiences for talks on mathematics education might be quite small, and budgets to arrange travel for speakers wanting, there might be room for an online seminar on this subject.

There were already some outlets for dissemination of innovations in university mathematics education. The AMS Committee on Education runs an annual meeting, and often hosts a panel at the Joint Mathematics Meetings. The MAA offers workshops during the JMM and organizes MAA MathFest. Here at MIT we are extremely lucky to have the wonderful publication outlet provided by OpenCourseWare. Since 2002, this organization has provided highly professional support for web publication of all course material produced for virtually all courses offered at MIT. Starting in the spring of 2015, this huge archive had been augmented by "OCW Educator," which offers peer-to-peer commentary about the aims and choices implicit in many MIT courses.

Above: An image from Jeremy Tyson's ESME talk, March 6, 2018.

But none of this offers the kind of continuous support for engagement that is provided by the innumerable standard disciplinary seminars conducted every week at hundreds of institutions around the country. We wanted to contribute to a growing and maturing professionalism in the discipline of university mathematics teaching, in analogy with the role played by these standard mathematics seminars.

The Birth of ESME

With the help of Lourdes Alemán of the MIT Teaching and Learning Laboratory I set up the Zoom contract and designed a poster. MIT math graduate student Hood Chatham adapted a website template designed some years ago for the MIT Topology seminar by Inna Zakharevich (now at Cornell University), and we were ready to go.

Grace put me in touch with the Curated Courses team, consisting of Petra Bonfert-Taylor (Dartmouth), Sarah Eichhorn (University of California Irvine), David Farmer (American Institute of Mathematics), and Jim Fowler (Ohio State University), and they graciously agreed on short notice to give the first "Electronic Mathematics Education Seminar," that took place on September 12, 2017. (It has now been renamed the Electronic Seminar on Mathematics Education, to forestall the impression that it is a seminar just on electronic mathematics education.)

Since then we have met every other week during term time. By the end of the 2018–2019 academic year there will have been 29 meetings featuring 39 different speakers. The website has evolved into a repository of video captures of the seminar presentations along with the slides and any relevant links to resources referred to in the talk. Attendance has ranged from about 15 to around 35. Beyond a core group, the attendance has been opportunistic—participants joining only when the topic

seemed particularly interesting—so the total number of attendees has been well over a hundred. At several institutions groups have gathered to view and discuss the seminar together. With microphones muted, this takes good advantage of the distributed medium! Zoom also supports a chat feature, allowing participants to communicate either privately between each other or to the group as a whole.

Benefits of Virtual Meetings

Several talks have made good use of the Zoom chat feature. Recently, for example, Alissa Crans (Loyola Marymount University) and Dave Kung (St Mary's College of Maryland), Project NExT leaders, talked on "Rising to the challenge of diversifying the mathematics community." Almost the entire talk consisted of participants responding on the chat to "scenarios" proposed on slides. For example:

> ### Challenging Scenario:
> #### Scenario #1
>
> Your calculus students work in groups of 3. Tori's an outgoing – and very good – student, but one day she's in a group with two guys. You notice that she isn't as active as usual. After class, she tells you they kept interrupting her and ignoring her ideas – so she just worked by herself.
>
> What do you do? (Type, Wait, Enter, Read)

The result was remarkable! Many participants chimed in. As the various suggestions appeared on the screen, the speakers could address them sequentially and efficiently, and participants could respond to each other. This really exploited the potential of this online medium. Several other speakers also gave highly interactive presentations—the talk by Angie Hodge (then at University of Nebraska Omaha, now at Northern Arizona University) "Inquiry based learning calculus" and "Active learning 2.0: Making it inclusive" by Daryl Yong (Harvey Mudd College) come to mind.

The range of topics addressed by talks in this seminar has been quite inspiring. A few more examples: Jeremy Tyson (University of Illinois Urbana-Champaign) spoke about the Illinois Geometry Lab. On the facing page is an image from his presentation.

Robin Pemantle (University of Pennsylvania) talked about the adventure of converting their calculus sequence to a worksheet based active learning pedagogy. Teena Gerhardt (Michigan State University) spoke about the transformation of their gateway mathematics subjects that she led there. Beth Burroughs gave an introduction to the MAA's brand new Instructional Practice Guide. David Pengelley (Oregon State University and New Mexico State University) spoke on "From lecture to active learning: Rewards for all, and is it really so difficult?"

Please go to the ESME website (math.mit.edu/seminars/esme/) to see the complete list, with lots of associated resources. The lineup going forward is just as exciting. Please join us some Tuesday at noon Eastern time for one of the Zoom-based Electronic Seminars on Mathematics Education!

Haynes Miller is Professor of Mathematics and emeritus Margaret MacVicar Faculty Fellow at the Massachusetts Institute of Technology. He served on the Technical Advisory Committee for the AAU Undergraduate STEM Education Initiative and is a member of the TPSE Mathematics Advisory Group and an editor of the International Journal of Research in Undergraduate Mathematics Education.

Electronic Seminar on Mathematics Education
math.mit.edu/seminars/esme
Upcoming talks

Apr 30 Tara Holm,
Cornell University

May 14 Eric Hsu,
San Francisco State University