Outline

- The problem
- The solution (that we came up with)
- The outcome
- Concluding remarks

Context

- Physics is…

Context

- Physics is… hard!

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- Physics is… hard!
  - Students must learn to apply calculus (which they are still learning) to develop mathematical models of the natural world.
  - Students must learn to design, to carry-out, and to analyze data from physical experiments.
- It takes practice to become proficient at the associated analytical skills.

Normally

- Flipped-classroom approach:
  – Weekly reading
  – 3 lecture per week, sit in groups, focus on Qlicker questions
- 3 hour lab/tutorial once per week, in groups
- Difficult assignments, due every week
- Exams and quizzes have a group component
- Drop-in sessions staffed by PHYS majors

ÆThe course is designed to **provide practice** thinking about physics and emphasizes **working in teams**.

Normally

- Physics is… ~~hard~~ fun!
- That's what most students usually say at the end of the course!
- The reason they have fun is because we make it more than just a course, it's an experience that they go through with their peers.
- The community that the students build in the course is critical in helping them to learn the material.

The problem

- How can we transfer the experience of the course online?
  - Maintain high standards.
  - Building a community that students can rely upon to help learn physics.
  -

The solution

- Ignored most advice given to us on remote teaching…

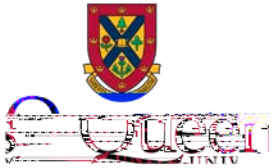
The solution: 1. Mandatory Synchronous Sessions

- Instead of lectures and labs: **mandatory 90-min long synchronous sessions, camera on, twice a week, Tuesday and Thursday.** For 24 weeks.
- 3 different time zone options (8:30am, 12:00pm, 4:00pm + BISC students)
- 9 TAs + 1 Head TA + BISC Instructor
- During sync sessions:
  - Students joined “TA-wide” chat group to discuss their results of a “Practice Quiz” administered on (Mon,Wed)
  - Students work on an experimental activity in small groups (TAs/prof, drop-in)
  - Students work on weekly assignments in small groups
  - Proctored quiz (ind + group) every 2 weeks
  - End of semester presentations on their experiments

Grouping students:
TA-wide group: ~25 students
Small groups: 3-5 students

Students had the same TA for whole year Æsmall classroom feeling

The solution: 3. Maintaining high expectations



- We gave students the same, difficult, weekly assignments to complete every week as they would normally. These cannot be completed without help (that's the point).
- We gave students difficult open-ended experimental projects to complete.
- We gave them too much work to do in 90min unless they came prepared and were efficient in dividing up the work with their teammates.

The outcome: 1. The community

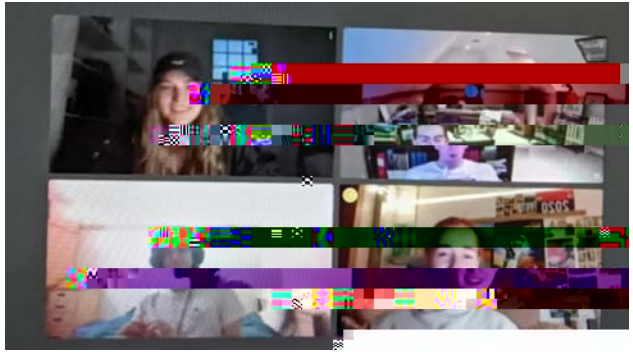
I have really enjoyed the phys104/106. In my opinion this was the best way to execute the online classes. This is the only class where I actually made some friends, and learned the most out of all my other classes. Although physics was an elective, and this was going to be my last year taking physics. But you guys really convinced me to take an extra year of physics just for fun.

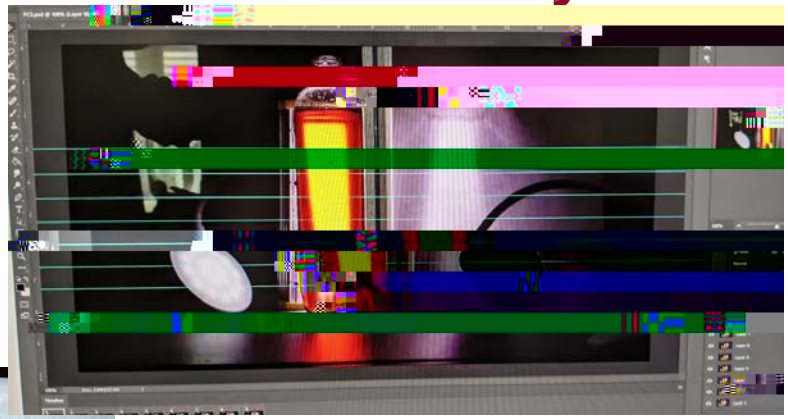
Even though the course was online, I was still able to sense the community that all of the upper years talk about .

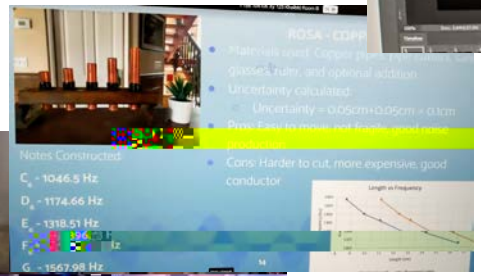
(…) definitely the most challenging and enjoyable class I had throughout the online year.

I really enjoyed the course and it challenged me in a good way!

The outcome: 2. What the community did







Concluding remarks

- Teaching and learning remotely sucks.
- Creating a sense of community appears more critical.
- It is possible to foster student collaboration in a remote setting such that they can produce something that is “more than the sum of the parts”.

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