

Facilitating Peer Interactions and Community-Building in a first-year course taught remotely (PHYS 104/106)

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Outline



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

Context



- Physics is...

Context

- Physics is... hard!

Context



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

Context

- Physics is... ~~hard~~ fun!

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.
 - Give student a fun experience with physics.

- Is it even possible from their bedrooms?



*"A sophisticated bedroom for a college student who comes home"
(Image search for "college bedroom")*

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

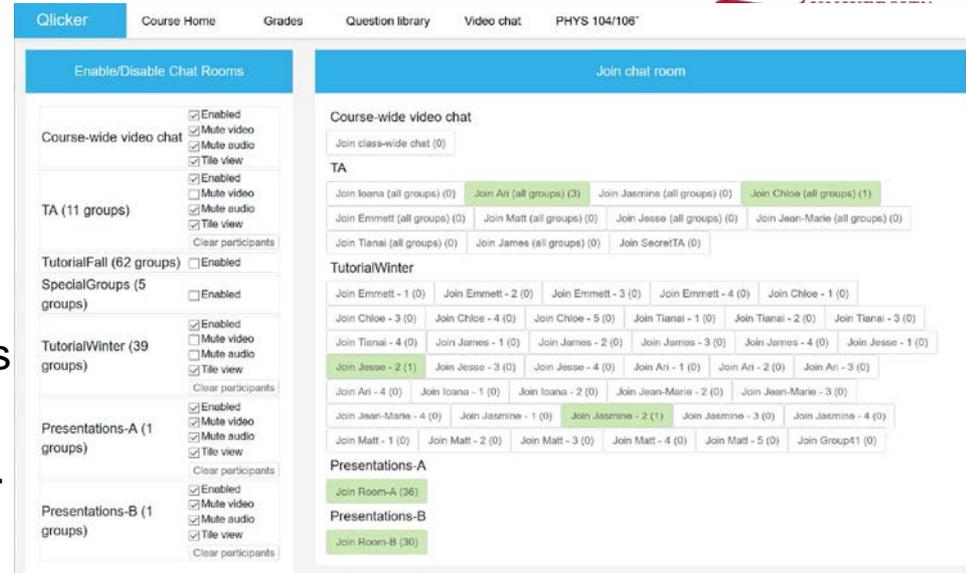
Students had the same TA for whole year → small classroom feeling

The solution: 2. Custom video conferencing system

- Integrated video conferencing into Qlicker (also used to administer 3 weekly quizzes)
- Various chat rooms that students/TAs/profs can easily join.
- Used for “drop-in sessions”.
- Students could use at anytime, as a central place to meet with their groups or office hours with TAs.
- Private and completely controlled at Queen’s.



The whole class during the December 2020 exam



Instructor dashboard showing various chat rooms (students only see chat rooms they are allowed to join)

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**.*

*I would just like to say that I really enjoyed the way that this course was done, and it was one of my only classes where I was actually able to **meet people and develops friendships** from.*

*(...) 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



“Standing waves”

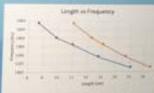
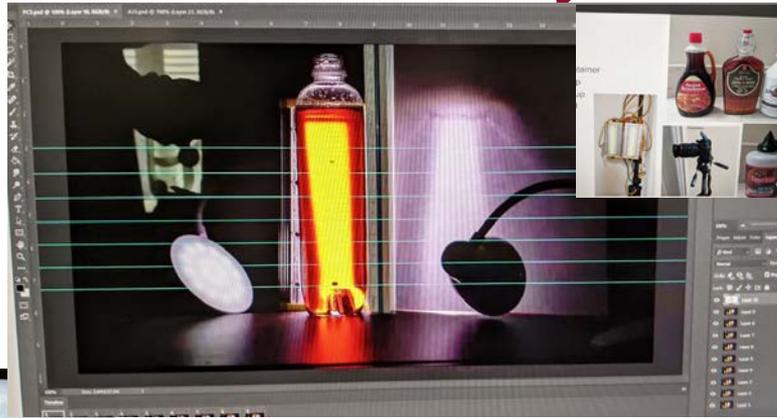


ROSA - COPPE

- Materials used: Copper tubes, water, glasses, ruler, and optional addition
- Uncertainty calculated:
 - Uncertainty = $0.050\text{m} \pm 0.050\text{m} = 0.10\text{m}$
- Pros: Easy to move, not fragile, good noise production
- Cons: Harder to cut, more expensive, good conductor

Notes Constructed:

- $C_1 = 1046.5 \text{ Hz}$
- $D_1 = 1174.66 \text{ Hz}$
- $E_1 = 1318.51 \text{ Hz}$
- $F_1 = 1394.91 \text{ Hz}$
- $G_1 = 1567.98 \text{ Hz}$

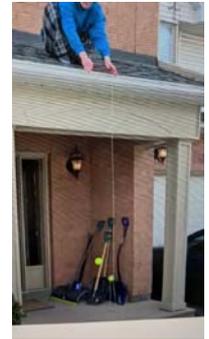



“Viscosity of maple syrup”

Different models that I tried



“Cloud chamber particle detector”



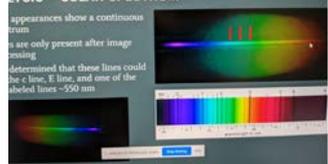
“Acceleration and chain”

LYSIS – SOLAR SPECTRUM

appearances show a continuous spectrum

are only present after image zooming

determined that these lines could be the c line, E line, and one of the labeled lines ~550 nm



“solar spectrum”

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”.

Concluding remarks



- Teaching and learning remotely sucks.
- It took a huge a number of resources to achieve whatever successes we did have, TAs in particular (1 per 25 students @ 10 hours/week). Not just any TA, Super TAs, really.
- I've heard good things from the students that were engaged in the course. I haven't heard from those that were not.
- While I think we did ok, and put in our best honest effort to make this work, I don't think the experience and learning was the same.