# Building community from afar: Teaching computation online to engineering students

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One of the greatest challenges in teaching online is to build a community of engaged learners. On top of many difficulties during the pandemic, students face schedule changes, zoom fatigue, isolation, and a loss of community which can lead to a loss of learning and disengagement from the online classroom - particularly when recorded lectures are posted online afterwards.

In our BME course sequence, Computational Methods is often taken during the first semester of classes in which students start in their "BME cohort" after taking math/science prerequisites for the degree. Students often do not know their peers or have a a set group for studying at the beginning of our semester. With mandated online classes, this gap widened for many. To combat this, several measures were taken to bring students together virtually and develop an engaged virtual classroom:

* **Engage on Day 1:** Spend the first lecture introducing yourself and briefly the syllabus. Underscore how students can communicate with you best and with each other during class. Most importantly, take the time to have each student introduce themselves, their area of interest in BME (or other field), and a fun fact (such as a pandemic project). Invite students to turn on their videos if they are in a comfortable space. Listen and engage with each student after their turn. This activity allowed students to share their name pronunciation, preferred pronouns if desired, and hear from their peers who may also be interested in a similar area - a great jump start to future group work and group projects in my classroom.
* **Set the stakes low for engagement:** Students complete simple MATLAB Grader practice problems before lecture. They are given unlimited attempts and receive points for honest efforts rather than for correctness. This helps learners prepare for the material that will be covered more in-depth during lecture/lab and for the instructor to also see where ALL the learners are in comprehension, not just those that speak up during class. If problematic, we spend time solving the problem together at the beginning of class and have a dialogue/PEARLs takeaway.
* **Create multiple entry points for questions:** Often, students do not feel comfortable speaking up in class (much less online in a zoom meeting with their video highlighted). Students are repeatedly encouraged to 1) ask questions in real time on the zoom chat box which their peers may answer before the instructor even sees, 2) send questions anonymously to instructor in zoom chat if desired, and 3) students can send anonymous questions in PearDeck used with the slides. We also use PearDeck for polling and other types of engagement throughout lecture. At the end of lecture PearDeck automatically sends students a copy of the presentation with their engagement answers. Students are also encouraged to unmute and ask questions at any point as they would in an in-person lecture.
* **Provide MLX notes:** To minimize popping back and forth between slides and MATLAB, I have developed "Lecture Notes" in MATLAB .mlx form. The students have enjoyed the ability to have formatted notes in MATLAB and these are pre-posted before lecture for them to download. They can then spend their time adding additional notes and listening, rather than taking a full set of notes. Furthermore, there are mini problems coded throughout with a comment for "% Solve this here". This allows students to actively type their solution during class or try it on their own while studying.
* **Create Learning Pods:** In each module, we spend time on "lab problems". Students are able to create their own learning pods (4-6 students) in breakout rooms which are then held constant for the semester. By self-selecting, students are more likely to engage with each other and participate. For those who do not self-select, the instructor forms additional learning pods and assists in building the peer network. By keeping the pods constant, students begin to build a learning community in class that extends to outside of class. Depending on the module complexity, each pod may solve a different problem and then we come back to the main zoom room for a "Regroup and Report". During "Regroup and Report", a designated reporter from the pod shares the problem and solution as well as any points where they struggled and what their PEARL is from the activity. This reinforces to all that struggles are acceptable and expected and by having the students share their PEARLS, they are more accountable and engaged in the process.