Recommendations for Inclusive Learning

For the Supportive Classroom STEM-vironment Workshop Series

This is a non-exhaustive list of recommendations for professors to implement in classrooms in order to build inclusive environments. Curated by the hosts (Ella Spurlock, Marina Gerton, and Michelle Cao) of the "Supportive Classroom STEM-vironment Workshop" Series in order to provide insight for the development of the content that will be presented in the workshop. The list broadly includes topics of Formative Assessments to Consider, Feedback Loops, Organization of Classrooms, Resources to Provide Students, Diversifying Voices in STEM, and Post-COVID. Each topic will include formats and examples in implementing these practices and the importance from a student perspective (a few topics will include our personal experience as students).

Key:

Examples of implementation,
Why it is beneficial,
Student stories

Formative Assessments (small, low stakes assignments):

These are regular assignments that are spread throughout the semester rather than a few high-stakes assignments/exams. Providing this structure can allow students and instructors to gauge understanding through a progressive format rather than a single cumulative format.

- *Quizzes*——A popular formative assessment style is regular (i.e. weekly) 15-20 minute quizzes that allow students to slowly accumulate points over the semester. These would cover only a few topics (for example, what was covered in lecture the past week). They also allow you (the instructor) to have a regular check-in with your students regarding content, thereby

showing you where students may still need help and allowing them to receive feedback on what they need to review.

- *Non-traditional Testing Methods*——It is beneficial to utilize assessments that are not strictly traditional exams. Exams are, by nature, rather high stakes and don't provide a super holistic or complete view of a student's understanding of a topic. Some examples include: exams with two parts (individual and group), multiple choice and long answer, swapping one midterm exam out for a research paper on specific topics, group projects, exam resubmissions, etc.
    - *Group Assessments/Resubmission Options*--- This can be applied to either exams or quizzes, adding group portions of assessments can encourage growth mindsets and provide an opportunity for students to get points back. Students can both learn from relaying concepts to peers and hear about different ways their peers are understanding topics.
      Examples on how to structure these group assessments: individual portion (worth more points, we recommend 80%) and a group resubmission of the same questions (less points, 20%), individual portion with short answer questions and a group portion with different long answer questions, in-class individual portion and a take home optional group portion with a time period to submit by the end of day or 24hrs.
- *Pre-Class Assignments*——Another form would be utilizing bi-weekly or tri-weekly (depending upon your class format) pre-class assignments that are designed to be quite short (5-15 minutes) but introduce students to the topic(s) covered in the upcoming lecture. These also allow students to obtain points in a way that will make a difference overall to their grade but where a singular assignment will not make or break their grade.
- This particular practice ensures that, grade-wise, there is a safety net for students should they struggle with one particular topic (and the associated assignments/assessments) or format (e.g. proctored timed exams vs homework), have something unexpected come up that intrudes into their ability to complete course work, or just need a mental break for a week. All of these are important facets of maintaining flexibility for students, through recognizing their identities as human beings, while also acknowledging that learning is a process, and we cannot always grasp a concept the first time around.
- *Michelle:* "There are a few weeks in the semester where I have larger assignments due, exams, etc. that switch up my schedule for that particular week. I'll often put too much focus on the assignment or studying for an exam and find too little energy or have forgotten to do my pre-class assignments but I don't stress about missing a

pre-class assignment here or there because they're regular and only worth a few points… which won't largely affect my grade…"

- *Marina:* I recently had a class that implemented weekly homeworks throughout the semester, which was great, but they were highly irregular and not worth much relative to the time we had to put in to complete them. They were released on different days each week, which would end up adjusting the due date in turn, so sometimes we had a week and a half between assignments, and sometimes only a couple days. This was incredibly hard as it meant that we couldn't really plan our schedules, and some of my peers ended up having work conflicts that made it rather difficult to get the homework done and attend group study sessions (collaboration was encouraged). Additionally, while some of the homeworks stretched up to 7-8 pages in length and required hours of work

Feedback:

Develop standardized feedback loops in the classroom so that you are connected to your students and the rest of your instructional team (if you have them); the students are connected to you and your instructional team, and the instructional team is connected to you and the students. Ensure that communication is expected and established, and where power balances exist, ensure that the privacy of those giving feedback is protected.

- *Seek feedback from the rest of your instructional team on a regular basis (if you have one)*——Establish a norm that during weekly meetings together, you will solicit the feedback and recommendations of the other members of the instructional team. They'll have opinions on how the class is running and will also likely have more insight into students' feelings on the matter.

- *Seek feedback from students*——Send out a mid-semester survey to the students, and consider offering it for credit; that way you can ensure that you'll get a good number of responses, and students can receive some points for the work they're putting into crafting feedback. Also, consider having a link that remains open throughout the semester that allows students to give you less structured feedback at any time (this can be linked through your Canvas page but can pull up a Google form). *These feedback mechanisms must be anonymous.* Due to the power dynamic between students and their instructors, many students are uncomfortable giving not entirely positive feedback in fear of retribution from their instructors. This then self-selects for students who are exceptionally comfortable with

you/don't have any constructive criticism regarding the course. Anonymity will fix this response bias.

- *Incorporate in-class feedback mechanisms*-----When solving problems with students during class, ask people to volunteer to share their thought process(es), which will give you some detailed insight into how at least some of the students are thinking about the concepts. Additionally, consider using clicker questions or Zoom polls to ask short questions and see what the majority of the class might still be confused about.

- *Utilize growth mindset oriented feedback in the classroom*——Instead of quickly telling students that they are wrong when they come to you with questions/worked problems, suggest instead that they may still have a misconception or misunderstanding that's influencing their thought process/problem solving. Work with students to then identify that misunderstanding and overcome it. Additionally, be sure to, even in grading schemes when possible, praise students for their efforts towards problem solving and award partial credit for work done that may not lead to a correct answer/result. The language you choose will have a large impact on your students.

- *Consider asking colleagues to sit in on a lecture every now and then to provide feedback to you*——Utilize your network of fellow experts to see what recommendations other instructors might have for you, particularly those who also teach/have previously taught the same course (and offer to do the same for others should they desire it). You are all great resources for each other, and know the nuances involved in running a course.

- Feedback is highly important to every aspect of the classroom as it allows all participating parties to grow and develop thereby achieving increased learning outcomes and a more welcoming environment. It also further strengthens relationships among participants in the classroom as it establishes channels of communication. It is important that students feel as though they have a voice regarding how they're doing in the course and what they need to see their goals met. It also benefits their learning to receive feedback on their progress within the course and where they might harbor misconceptions. For instructors, it's important to recognize where students feel their needs are not being met, and what might be done about that. There are plenty of times where the strategies we're implementing don't have the effect(s) we think they do and small timely modifications can make a big difference for students' success.

- *Michelle:* I often fear approaching my instructors for help I mostly don't even consider office hours because it feels too personal and I fear being perceived as an "imposter" in the class… Chat functions, discussion boards, surveys before and after a quiz, and spaces for

collaborative learning makes me feel less alone in my struggles when instructors provide them.

Resources/Organization:

The course structure is crucial to student experiences and learning outcomes, as well as to a well-functioning course. Trying to make things as clearly outlined and accessible as possible, while also providing supporting resources for students, will help to develop a positive and welcoming environment that also reduces unnecessary stress for students, and ultimately also for you as an instructor.

- *Utilize technology-based lecture formats*——(i.e. PowerPoint, Notability, etc.)
- *Upload notes and slides to your Canvas page*——(pre- and post-lecture forms)
- *Use partial notes or skeleton notes*——research has shown this approach significantly improves students' note taking and understanding of a course (source)
- *Make use of redundancy*——referring back to previous content helps students build connections.
- *Consistently remind students of University of Utah's resources*—— These include Online Tutoring, Tutoring Centers, Mental Health Resources, Research Involvement Resources, Scholarships, Center for Disability and Accommodations, Women's Center, LGBTQ Resource Center, General Opportunities, etc. Provide resources open to all students throughout the semester as you hear about them!
- *Ensure that you give clear instructions and incorporate regular outlines of lectures*
- *Implement small group learning*——When running group work in the course, keep the groups to 3-4 people in order to promote better group dynamics. Larger groups tend to become chaotic and/or can more easily allow some people to become particularly dominant or silent while smaller groups tend not to have great participation from and discussion amongst students.
    - Consider starting group work with students individually looking over the question before breaking out into groups (5-10mins). This can allow students to have an initial understanding and build an immediate response to approaching the problem, lessening the effects of an unbalanced group dynamic.

- *Have breaks during class*——This allows you to give students mental breaks, ensuring that they'll be more able to continue focusing on the lecture, and accommodates students who, for physical or psychological reasons, may need to get up and move around. Additionally, this is a great time for you as an instructor to solicit spontaneous questions from students or even more casually interact with your students and build a relationship that way.
- Working through a lens of UDL (Universal Design for Learning), proactively providing accessibility (in its different forms) will benefit all students.

Diversifying Voices in STEM:

> *Though it may be the narrative that has traditionally existed in STEM fields, STEM is not 'pure', not unbiased, not born through the European Scientific Revolution, and is not practiced by one homogenous group of people. One of the very interesting things about STEM is how different approaches to the same problem can lead one to the same conclusion/result, or can lead to different complementary results, but many students do not realize this (at least when they're first starting out on their STEM path). Highlight different problem solving methods, and the different people and cultures that have contributed to our current practices of STEM.*

- *Introduce Non-Traditional Scientists*——include scientists in your lectures that are not spoken about in the text in order to create visibility for students that are not white or male.
- *Highlight Scientists that Identify as Part of a Celebratory Month/Day*——these range from PRIDE month, Autism Awareness, Black History Month, etc.
- *Include Diverse Approaches/Ways to do STEM*——Mathematics (for example) can be interpreted many different ways. Graphical representations have been introduced that go beyond the cartesian coordinate system. There are generally numerous ways to approach a problem and problem solving that should be acknowledged and recognized, as well as different approaches to science itself (not just the eurocentric Scientific Method that has been standardized).
  - NOTE: We understand this can be time consuming to realistically implement, consider hearing from other instructors/colleagues
- *Implement mechanisms that accommodate for ELLs* (English Language Learners)——this can include offering the option for students to write papers in the language that they're most comfortable with, and

you can then translate for them (this is made even easier if you're allowing students to submit assignments online). Provide visual representations of topics when possible that can be generally understood without complex language.

- Increasing the visibility of non-traditional STEMicists and highlighting the work of those that came before the most visible (and traditionally white male) researchers both reinforces that STEM can be done not just by one specific group of people, but can also make your students who might be considered non-traditional feel seen and encouraged. Additionally, incorporating mechanisms to support ELLs and presenting diverse methods of doing STEM increases accessibility in your classroom as it will allow ELLs to more fully engage with what is happening and recognizes that some methods of presentation don't make sense to every student.

Post-COVID specifically

- Technology-based lectures (i.e. PowerPoint slides, notes on a tablet, etc.)
  - **Importance:** this typically results in more readable lecture materials that you can save for your own use and student use later on. Additionally, it provides a good mechanism for blending in person and virtual learning, allowing students to easily view and follow the lecture materials regardless of how they're attending their classes
  - **Incorporate educational technologies:** PhET simulations (for example)
- Record lectures
  - **Importance:** this is incredibly useful for students for a number of reasons. It allows them to easily study from the material that you yourself actually cover in lecture, and go back and view the minutiae that they might have missed the first time around, and allows students to easily cover lecture material if they have to miss a day in class (for whatever reason, we all know these can be numerous and incredibly valid)
  - **Flipped classrooms (if unable to record lectures, or just in general):** two-types - all content material ahead of time with only worked problems in class or have content overview ahead of time with lectures in class still
- Post slides (pre-filled and post-filled)
  - **Importance:** This provides good organized study material for students to refer back to as they're preparing for assessments and the like. Additionally, it allows students who may have missed a day to go back and see what was presented, and can allows students who have a harder time following lectures to prepare for what they will see in class
  - **Have basic outlined notes to start, then the complete to end**
- Allow students to submit most assignments online (via Canvas, Gradescope, etc.)

    - **Importance:** Gradescope has a built in Blind-grading policy that will lessen biases, students who cannot be physically in person due to a commitment will still be able to access the assignments/submit assignments,
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- Incorporate optional IVC
    - **Importance:** Numerous students will have a variety of reasons to want to stay IVC at least part of the time, whether that be for physical or mental reasons, or possibly for travel, and this would allow them to stay engaged with the course even if they cannot/will not be physically present for the day. It's a great way to also demonstrate to students that you care about accessibility and are willing to accommodate them as humans
    - **Cameras that will follow you:** trial run in smaller classrooms in STEM buildings, great way to accommodate for your students' various situations
- Offer students ability to meet with you virtually
    - **Importance:** It can be very intimidating for many students to meet one-on-one with their instructors for help, and sometimes having the spacial separation of a screen between the two of you can reduce that anxiety and fear for students. Additionally, this again allows for greater accessibility within your class, rather than requiring that students make their way to your physical office space on campus
    - **Office Hours vs. "Study Halls"** office hours generally have a connotation of meeting one on one with professors which can feel intimidating for many non-traditional students. Consider replacing office hours with a group study period open for all students to be able to work together and with a range of the instructional team to help (LA's, TA's, the instructor). Additionally, many times students will not visit a physical space for assistance especially if they do not live near/on campus. Having study halls online (zoom) will garner more students joining and working together.
- BE FLEXIBLE
    - **Importance:** One thing this year has shown all of us in clear detail is the importance of flexibility in all aspects of our lives. Things will happen for everyone, and it's incredibly important for you as an instructor to recognize the humanity and human experiences of your students. They, in turn, will then also likely be more flexible with you as things come up
- Have breaks during classes (particularly those longer than 50 min)- mental and physical breaks, and spontaneous questions.
- Allow students multiple options for learning.