STEM-NET Webinar "Inquiry-Based Learning"
***Questions from the webinar (04/15/ 2020) at 10:00am) attendees:**

1. *As a Spanish professor, part of my professional commitment and engagement to serving our students involves contributing to a solid intellectual and linguistic foundation for our bilingual (Spanish-English) students as they pursue studies in a range of disciplines in the sciences, social sciences and humanities. What suggestions might you have for how I can integrate IBL into an advanced Spanish course(s) for incoming first year Latinx Spanish speakers?*

   Presenter Response: Spanish is not my area, but there are some generally useful advice to give tasks for students to read and inquire together about a reading. There is a book by Finkel "Teaching With Your Mouth Shut" (Link). It might be out of print, but there are copies around. He comes from a humanities background, so this is why I think it's relevant to language arts.

2. How is IBL related to environment issues?

   Presenter Response: I think the framework I would use is problem-based learning. So, the environment has major issues or problems. Then reverse engineer from those problems' readings, tasks, etc. to get to the main learning goals. One idea for an output is to have students write a report to a city or other entity recommendations.

3. How do these courses/ experience relate/same to or differ from GUREs (course-based undergraduate research?

   Presenter Response: At least in Math, I think of IBL classes as a version of research or parallel to research. The basic difference is that the results are already known, but to the students these are new results. So, the process of rediscovery via research at their level is definitely in the same category of course-based undergraduate research.

4. *What are the financial considerations for running inquiry-based labs, preparation for the labs, maximal number of students who can be accommodated?*

   Presenter Response: This will depend greatly on your learning objectives. We had equal learning when we did demonstrations at the front of the room versus hands-on activities in classes of ~36 students (although we like the kinesthetic aspects of the hands-on), and others have shown equal conceptual gains when using simulations vs experiments in heat transfer. Some of our hands-on materials were very inexpensive and fairly small and could work in a large classroom setting.

5. *There are a number of these techniques applied for early physics/math courses or lower-level engr. courses. Will there be discussion about integrating this approach for upper-level engr. courses or upper-level STEM courses in general?*

   Presenter Response: The physics community has worked on this. Check out **Oregon State**, **CU Boulder**, and **PhysPort** for examples of materials.

6. *What are best practices and where can we find resources?*

PhysPort is a great site for physics-related resources, as well as general explainers and expert recommendations that could be useful in other STEM fields.

7. How do I incorporate IBL into courses and curriculum?

I recommend checking out the Academy of Inquiry Based Learning site for videos, curriculum (in Math), and much more
http://www.inquirybasedlearning.org/ibl-video
materials: http://www.inquirybasedlearning.org/new-page

8. How is IBL implemented at both a lower division general education level and at the upper division major level? Are there differences in approach at the different levels?

Presenters Response: I think students' level of sophistication in how they engage with the material, as well as their interest in the material is a big difference that affects the types of things you can do. If students do IBL at the lower division (or in K12), they may develop some more generalized inquiry skills. But students at all levels can ask and answer questions, conduct experiments, argue from evidence, etc.

The Next Generation Physical Science and Everyday Thinking materials are suitable for GE students.

10. How does one assess IBL?

Presenters Response: It's useful to start with the goals or student outcomes, then figure out how to assess those - I think that's common to any assessment process. But in IBL, we may particularly care about and want to assess **process** focused outcomes (not just content outcomes). These might include students' ability to engage in sensemaking, design an experiment, and argue from evidence. Assessing these (and even operationally defining them) can be challenging. But if all we use are content assessments, we may miss much of what students do and learn in an IBL course. Finally, it's important that assessments for grading purposes are aligned with classroom activities, HW, etc.

11. What are some ways to apply inquiry-based learning in upper division STEM courses? How does it scale?

Presenter Response: Upper division is easier to implement a more engaged, immersive version of IBL. So, in Math we give students a well-ordered sequence of tasks that leads them to the main results we want to get to. And then they prove them one by one and do research at their level. Where it's harder to implement in Math is in lower-level courses, where students come in with a wider range of backgrounds and have not all learned how to learn well yet.

12. What are ways to support TAs in inquiry-based teaching in lab sections?

Presenter Response: We are incorporating Learning Assistants (LA)in some of our courses, and we have an associated course where the LAs learn about teaching techniques. The Learning Assistant Alliance https://learningassistantalliance.org/msg-from-the-laa.php has a lot of great resources.

14. How is IBL different from other types of active learning such as TBL and POGIL? What are the advantages and disadvantages?

Presenter Response: My view is that we are all under one big tent, and there are different versions of IBL that fit the needs of students, instructors, and the institutional environment. The four pillars of IBL (in Topaz and my talk) is the common ground. I think it's important to distinguish between the types than it is to focus on specific, individual circumstances.

15. *How to do you assess student learning? How do you adjust instruction to serve students with variable level of preparation?*

Presenter Response: Some ideas: Multiple methods of assessment (in addition to exams/quizzes, include projects or papers, group work or audience participation (for presentations), reflections) + mastery-based grading. Students learn a lot from one another which can help level differences in preparation.

16. How to promote IBL in our emergency on-line delivery?
Presenter Response: First this is hard. It's not an area we have developed expertise. What people are trying are breakout rooms, think-share activities, and using tutorials where students get a handout that leads them through the work. The key here is engagement in the material and having some opportunities to hear other people think through something.

18. What are good assessment strategies- especially in virtual classroom?
Presenter Response: For virtual, I am suggesting people move towards Mastery-Based Grading or Standards-Based Grading. Take-home quizzes or exams that are more conceptual also fit in this environment.

Please also check out Francis Su's post: https://www.francissu.com/post/7-exam-questions-for-a-pandemic-or-any-other-time

21. What ideas do you all have for moving senior level (e.g. graduating seniors) in person research projects-based lab class to a virtual environment?

Presenter Response: Advanced undergrads are more malleable. I think it makes sense to give them papers, book, articles, projects, and make them more responsible for finding their pathway with guidance of course. Labs are of course a challenge. In Math, we can of course assign problems or data sets or papers to read. I think literature reviews can be a good place to start. There's plenty to read out there :)