

FIG: Active Learning in STEM

Lane Community College, Fall 2020

Members

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Summary

We met 7 times throughout the term, and spent 3 weeks working asynchronously in advance of meetings. Here are the topics we explored:

Week	Topic
1	What is Active Learning? What is Reflective Teaching?
2	Meaningful & Engaging Assessments / Assignments
3	Exploring Active Learning Strategies
5	Active Learning Poster Presentations
6	Metacognition and Feedback
7	Sense of Belonging & Science Identity
8	Challenges in the Active Learning Classroom
10	Implementation Plan presentations

Outcomes

1. We worked collaboratively to make an [Active Learning Poster Collection](#) based on our interests and strengths.
2. Our members developed implementation plans for Winter 2021 related to the topics we discussed this term. Here's what they have in store:
 - Jennifer is looking into more interactive labs for biology. She will evaluate her implementation using student surveys, and direct feedback from grading.
 - Richard is incorporating new examples and lab activities related to cooking into his physics class. He will measure results using midterm and end-of-term evaluations, as well as exam scores. If it works well, it might be worth applying to create a new course, and partnering with the culinary program (since those students have to take this physics class, and this would be topically quite relevant with the new examples). Richard will be careful to watch for accessibility issues (do students have access to kitchen?) but is excited about making the topic more relevant to students.
 - Lisa is working on providing more effective and timely feedback by automating some of her grading routine, improving the questions she asks (in homeworks, pre-class readings, and exercises), and adding video and other multimedia forms of feedback. This work will benefit both the remote and in-person settings, which Lisa feels is a good use of limited time (we don't want to pour too much effort into this temporary, remote environment).
 - George is focusing on building active engagement and community in his remote class, by inviting students to work in groups on coursework during office hours. Within these sessions, he may also try think-pair-share and Google Jamboard. George will measure the success of his intervention through attendance at these sessions, and correlating attendance with exam / course grades. He is willing to try a teaching pairs style observation to gather feedback from faculty.
 - Alex is working on a scaffolded poster project, with the aim of improving science identity, giving students a real science experience, and fostering critical thinking (how to form and answer questions). She will use a class dataset to generate potential hypotheses, have students choose a hypothesis and plan a data analysis in groups, do this analysis, and then create, present, peer-review, and self-reflect on posters. Alex will measure the success of this project using student questionnaires and evaluations, their work, and other faculty that teach this course.
3. All participants are interested in following up on our plans with a meeting near the end of winter term. We may continue meeting a few times over the course of Winter term to help troubleshoot and provide support to one another, and keep our learning community going.
4. Some participants are tentatively interested in presenting at the Faculty Research Symposium in the spring.

Meeting Resources and Materials

Week 1: What is Active Learning? What is Reflective Teaching?

Pre-workshop Evaluations

- [Teaching Practice Inventory](#)
- [Teaching Practices Inventory Results & Reflections Survey](#)

Note: These will be re-evaluated at the end of the Winter Term, after participants implement their active learning plans.

Reading

- Explore the page "[What is active learning?](#)" from University of Minnesota.
- Read the page "[What is reflective teaching?](#)" from Yale's Poorvu Center for Teaching and Learning
- Optional: Read "[Is lecturing racist?](#)" by Freeman, S. and E. Theobald, Inside Higher Ed., 2 September 2020.

Introductions & Goal-Setting

- What is your name, pronouns, and discipline?
- How do you define active learning? What methods are you most familiar with?
- What does reflective teaching mean to you? How do you reflect and iterate on your teaching now? What do you think would improve your reflective practice?
- What do you hope to learn in this FIG and be able to do as a result of participating?
- Please post a picture of yourself doing something you love.

Notes

Our definitions of active learning were fairly congruent:

- When the students are doing more than just sitting there watching. I frequently use an informal think-pair-share (especially if people aren't asking questions or aren't responding to discussion questions I throw out). And of course the various lab activities.
- Anything that gets students engaged with the instructor and one another - I want to see the gears spinning.
- Student involvement
- Students are active participants in their own learning, meaning they need to do something with material they are thinking about

Everyone had some method for reflective teaching:

- Keeping notes about what does or doesn't work, and then editing based on those notes.
- Surveying students

- Doing things for a reason: setting goals, and then evaluating whether teaching is meeting those goals.
- Acknowledging to yourself what worked and didn't and perhaps why
- Think about why they do things, and using information about how things went for continual improvement
- Using a variety of techniques to assess your class and teaching style - body language, evaluations, etc

Our goals included:

- New techniques and ideas - especially on how to engage students remotely
- Turn around the downturn in student performance in the remote setting
- How to manage active teaching
- Encouraging students and providing useful feedback
- Accomplishing these goals with a reasonable workload (for faculty and students)
- Learn about all of the active learning methods that are already going on at LCC
- Build community

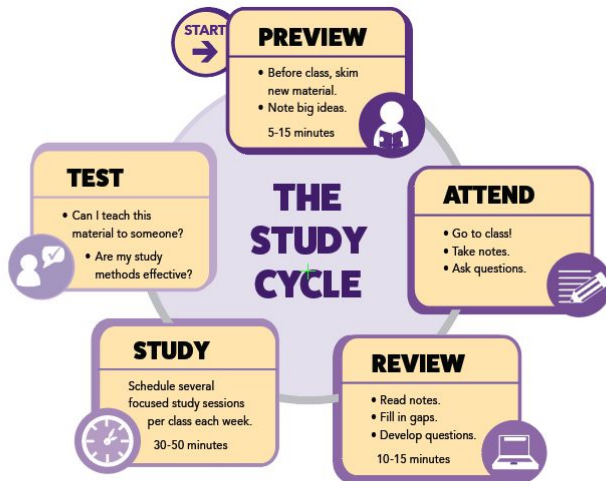
Week 2: Meaningful & Engaging Assessments / Assignments

Reading

- Read the page [Bloom's Taxonomy](#) by Vanderbilt University's Center for Teaching.
- Explore [LCC's assessment Cycle](#) page which describes the backward design process.
- Skim the [Bloom's Taxonomy Verb Wheel](#) (this version includes "verbs" to describe learning goals on the inner ring and assignment/assessment examples on the outer ring)
- Also skim [Fink's Taxonomy of Significant Learning](#), which considers aspects of learning that are neglected in Bloom's Taxonomy.
- (Optional): "[Beyond Bloom: Expanding our Ideas about Learning Objectives](#)" by Bridged Arend, PhD, from University of Denver.

Meeting

- [Slides](#) - Backward Design, Meaningful Assignments/Assessments
- Image below: Mentioned in the meeting: I use this image to explain my rationale for course design to students. - Andrea



Adapted from Frank Christ's PLRS system.
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<https://www.lsu.edu/cas/images/graphics/studycycletest.png>

Forum: Learning Goals, Assessments, Activities

If you were able to make the synchronous meeting, answer these questions:

1. Is there a single, simple takeaway from today's session that you can apply immediately?
2. What question do you still have about Backward Design or assessment?

If you were unable to make the synchronous meeting, answer these questions (anyone is welcome to respond!)

1. Articulate one example of backward design from your own teaching:
 - Name one concrete learning goal.
 - How do you assess that goal?
 - What student experiences support this goal?
2. What ideas come to mind when you think of:
 - Scaffolding student learning?
 - Engaging activities?
 - Meaningful assignments / assessments?
3. Does your mind meet these ideas with excitement or resistance?

Notes

- Some participants mentioned they hadn't done think- pair-share in online (Zoom) format before - we did this during the meeting - and noted specific things that help, such as adding the question prompts to the chat window before creating breakout groups
- In discussing backward design, we noted that it would be helpful for instructors that teach the same course to have more frequent discussions about how they interpret the course learning objectives

Week 3: Exploring Active Learning Strategies

Reading and Forum

Step One: Reading (10-15 min)

- Read SERC's main page on [Active Learning](#), and the section on "Why use engaged pedagogies?"
- Prime your mind by skimming "How to use active learning" (just the main page, not following the links - unless you want to)

Step Two: Answer these Questions (~5 min)

1. What "approximation of practice" or "habits of mind" in your discipline do you want students to experience?
2. What skills and competencies do students build in your class that are useful outside of your discipline (in a variety of professional contexts)?
3. Which of these "constraints" is most important to you when considering new teaching methods?
 - Learning goals for the activity
 - Faculty experience and familiarity with the specific teaching method
 - Student experience and familiarity with the specific teaching method
 - Physical classroom configuration
 - Class size
 - Time available (classroom and preparation)
 - Topical content involved

Meeting Resources

- [Slides](#) with discussion prompts and polls
- [Google Jamboard](#)

Notes

- Habits of mind we came up with in our forum:
 - Systems thinking
 - Evaluate science and media for accuracy and loopholes
 - Being excited about science!
 - Evaluate information quality
 - Be able to figure out "strategies" to problem solving before procedures
- Skills and competencies useful outside of class:
 - Seeing interconnectedness - including how humans interact with natural world
 - Thinking and analyzing at large scales
 - Working collaboratively

- Organizing information
- Critical thinking
- Understanding diagrams and graphs
- Process information effectively (graphs, data, or contextual questions)
- Our biggest constraints:
 - Faculty experience / familiarity
 - Time!
 - Dealing with differing levels of student prep for class
- Strategies we have used and like a lot:
 - Think-pair-share
 - ConcepTests
 - Minute Papers
 - Lecture Tutorials
- Strategies we've used but don't like much:
 - Jigsaw
 - Gallery Walk

Week 5: Active Learning Poster Presentations

Poster Instructions

1. Read (20-30 min): Explore active learning strategies based on your [specific goals](#) or [time investment](#). This list of [classroom assessments and activities](#) may be helpful too.
2. Reflect: Choose one technique that you either do well already or want to implement
3. Share (15 min): Choose one way to share:
 - Preferred: Add a poster to our [Active Learning Poster Collection](#) using our template, and drop the link on our forum (reply to this post). I hope this act of creation and sharing makes this a “Meaningful Assignment!” I'd love to share these with others, with your consent.
 - Alternative: Describe your technique on our forum. Include a description, a concrete example, and any references you consulted.

Notes

Participants contributed to our FIG's: [Active Learning Poster Collection](#)

- Principled Problem Review
- Using Google Jamboard
- Teaching with Geobrowsers

Week 6: Metacognition and Feedback

Reading

Step One: Reading (10-20 min)

- Skim the SAGE 2YC resources on [Developing Self-Regulated Learners: Choosing and Using the Best Strategies for the Task](#) (~5-10 minutes)
- Read the page on [Activities that Develop Self-Regulated Learning](#) (part of above) (~5 minutes)
- Read the article [Students Who Seek Feedback, Use Feedback](#), for an introduction to more effective and impactful feedback strategies. (~5 minutes)
- If you'd like a brief introduction to the idea of metacognition, watch the video (5 minutes - https://youtu.be/P_b44JaBQ-Q)
- (Optional): Read [Promoting Student Metacognition by Kimberley Tanner \(2012\)](#). CBE—Life Sciences Education v. 11, 113–120. (~30 minutes)

Step Two: Answer these Questions (~5 min)

1. What is something you currently do to incorporate metacognition in your courses? Do you think that strategy is effective at encouraging students to assess their own learning?
2. What is one idea you have for a way that you could incorporate a new metacognitive practice?
3. Do you feel that the feedback you provide to students is 1) Useful, 2) Timely, and 3) Actually used by them in a clear way? If not (if, like me, sometimes you feel like your carefully-crafted comments are never going to be read), what strategies might you use to make your feedback more effective and impactful?

Meeting Resources

- [Slides](#) with discussion prompts and polls
- [Google Jamboard](#)

Notes

- The metacognitive things we do:
 - Make concept maps in groups with a recent topic
 - Weekly or semiweekly writing reflections, generally focusing on study habits
- The metacognitive things we want to do:
 - More 3-2-1 activities (3 things you learned, 2 things that surprise you, 1 question you still have)
 - Minute papers (write down the most significant thing they learned that day) - this can be done in the Zoom chat box
 - Exam wrappers in the way described in the article we read (doing assignments both before taking and after taking, but before getting back, the graded exam)
- Our ideas about whether our feedback is useful, timely, and actually used by students:
 - Useful and timely... yes, but encouraging, sometimes not.
 - We usually try to point out mistakes, or ask questions to push their thinking further, rather than just telling them the correct answer
 - Sometimes being timely is a challenge...

- We are not sure how much students read our comments on their work, especially online.
- We'd like to give better feedback, like tips on how to improve
- Our discussion about feedback was very rich:
 - The more we automate the “basic” feedback, the more time we have to give substantive feedback
 - On Moodle, automating can mean copying/pasting the same comment to all students with the same mistake. But it can also mean using the “general feedback” field on the Quiz activity
 - Students use feedback more when they can do something with it - such as exam or homework corrections
 - Evaluating many responses to the same question is tedious, and with online teaching, reading so much work on a screen is a pain (and sometimes painful!)
- Challenges
 - Grading can be a chore
 - Can lose steam near the end of the term (students and faculty)
 - Students use feedback more if they can do corrections but otherwise, can't tell
 - Students read more if it's on the grades page
- Opportunities
 - Post keys for “boring to grade” assignments or use auto-graded assignments & general feedback
 - Zoom chat box for “most important point”
 - Timeliness - easier if assignments spaced out
 - Moodle makes it easier to leave comments (copy/paste!)
 - Easier for students to use feedback for long-term projects
 - Multimedia assignments - cut down on reading many pages

Week 7: Sense of Belonging & Science Identity

Reading

- [Develop Students' Science Identity \(from SAGE 2YC program\)](#)
- [Foster a Sense of Belonging \(from SAGE 2YC program\)](#)

Meeting Resources

- [Slides](#) with discussion prompts and polls
- [Google Jamboard](#)
- Articles mentioned in the meeting:
 - [Harackiewicz et al. "Closing the Social Class Achievement Gap for First-Generation Students in Undergraduate Biology." Journal of Educational Psychology, 106\(2\), p. 375. \(2014\).](#)

- Miyake et. al. "Reducing the Gender Achievement Gap in College Science: A Classroom Study of Values Affirmation." Science Magazine, 26(6008), p1234. (2010).
- Related: "OPINION: Let's Stop Calling It an "Achievement Gap" When It's Really an Opportunity Gap" by Mike Yates on We Are Teachers

Wrap-Up Reflection

Reflect on one strength, one challenge, and one opportunity when it comes to helping students feel a sense of belonging and building their science identity (at any level - classroom, discipline, division, or institution).

Notes

- Belonging & Curricular materials
 - Using diverse names, photos, examples
 - Highlighting diverse scientists
 - Talking to students (or giving them writing from) previous students who struggled but have ultimately been successful
 - Using lower-cost resources to be inclusive of lower income students
- Belonging strengthened through active learning by...
 - Case studies incorporating diverse populations
 - Active learning and lab activities gives students the sense of doing science
 - A way to find peers to study with
- Belonging and science identity are addressed **specifically by discipline** by...
 - Being careful in genetics to avoid overemphasizing differences
 - Discussing specific diseases and case studies
 - Doing field work
 - Student organizations within the discipline
 - Literacy about the physical world we all live in
- Belonging and science identity are addressed **similarly across disciplines** by...
 - Aligning learning goals for required courses in other disciplines
 - Doing Labs (STEM)
 - Giving students tools they can use in the future in their own life / real world

Week 8: Challenges in the Active Learning Classroom

Forum

This week, we'll discuss our intentions for implementing new active learning techniques (or refining the ones we already use), and solving problems as we implement.

Please answer these questions:

1. What idea(s) do you have for something you'd like to implement in your classes next term? Your idea(s) can be small or large, specific or vague, and apply to just one class or to all classes you teach - we will work together to flesh these out.
2. What obstacles might you face in putting your idea into practice? (Some examples: preparation time for new activities, making time for activities in your class, ensuring students are prepared to do the activities, problems surrounding group work, grading workload, student workload, remote considerations, measuring efficacy.)

You may find it helpful to reflect on your [initial goals](#), and what we have discussed surrounding [designing and scaffolding learning activities and assessments](#), the ["why" behind active learning](#) and [specific active learning techniques](#), [metacognition and feedback](#), and science identity & belonging (all links in this sentence go to the relevant forums on our Moodle page).

Meeting Resources

- [Slides](#)
- [Google Jamboard](#)

Notes

- This week we did a “six hats” analysis of our ideas for implementing new active learning practices.

Week 10: Implementation Plan presentations

Reading

- [Gathering, interpreting, and responding to feedback \[from students\] \(UMN\)](#)
- Feedback from Faculty:
 - [To get ideas about what to ask colleagues to watch for, you might explore this teaching observation protocol](#) - click the arrows that say "Show Subscale Items" for specific ideas.
 - This advice on teaching pairs is from personal communication with Carol Ormand (a SAGE leader) - her words are in direct quotes:
 - "Pay attention to specific elements -- were the students engaged, were all of them engaged (or who wasn't?), was anything I did or said confusing to the observer?"
 - Pair observations with very specific timekeeping, and describe both instructor and student behavior. These can be quite detailed and granular.
 - It can be nerve-wracking to invite our colleagues into our classrooms. We are so used to teaching as a solitary endeavor, and having a colleague observe us can make us feel vulnerable. But I found my colleagues' observations really valuable -- totally worth feeling a little extra nervous for a day."

- (As I read this, I realize we must answer these questions: What does student engagement look like in an online class? What constitutes evidence for student engagement, and how would you look for it when observing a remote class?)

Implementation Plan Instructions

Your plan should include:

- Purpose and goals: what problem in your class are you trying to address? What are you hoping will change (in student achievement, classroom environment, your own experience, etc) as a result of your new/improved methods?
- Methods: what practices or techniques will you use? When and how will you use them? What contingencies are you planning for? What specific obstacles are in your way currently, and how will you address these?
- Measuring results: how will you gather and use feedback from students, faculty, and your own observations and reflections (to tell you whether you have achieved your goals, and make changes for the future)? Would you like to work in a teaching pair with other faculty?
- Communicating results: when and how will you report back to our group? Are you interested in a follow up meeting (or more than one) sometime during or after winter term? Are you interested in presenting at the Center for Teaching and Learning's Spring Symposium (sorry I don't have a lot of details on this event, aside from knowing that such a thing is being planned).