Active Learning in a Remote/Hybrid Environment

New Faculty Remote Workshop,
August 5 - 9, 2021

Peg Harbol, PhD, Cascadia College, Bothell, WA

With help from previous facilitators and colleagues

ACS Chemistry for Life™

COTTRELL SCHOLARS COLLABORATIVE
Integrating Discovery and Education to Advance Science

Outcomes and Deliverables:

- Engage with a few active-learning strategies using a gen chem lesson
- "Pull back the curtain" - dissect a lesson & instructor
- Consider active learning in the remote teaching environment - adaptations for synchronous/asynchronous teaching

- Google doc worksheet, asynchronous small group discussion (Canvas), and Class titration curve
- Incorporate an active-learning experience in your Teachable Tidbit!

“Active Learning is helping the learner construct knowledge and understanding or make sense of the science/chemistry."

Previous presentation

Lombardi, D.; Shipley, T. F. The curious construct of active learning. *Psychological Science in the Public Interest* **2021**, *22*(1), 8–43.

Active Learning Requires:

- Engages students in the learning process
- Students to do meaningful learning activities

- Students to be present
- Students to participate

- Activity <u>is</u> the lesson/instruction

(https://www.viewsonic.com/library/education/active-learning-matters/)

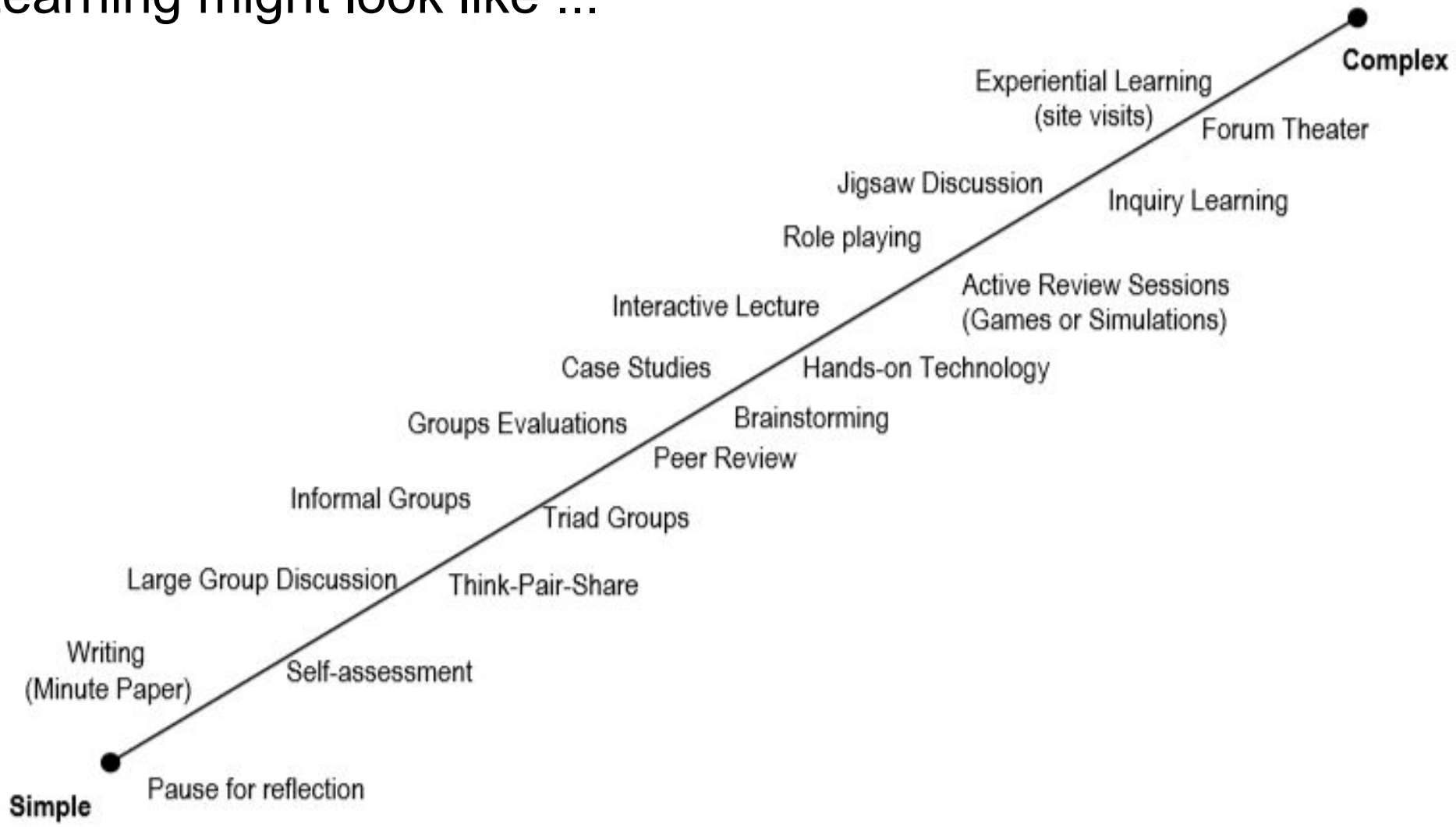
The Scientific Practices provide template for Active Learning

- Asking questions and Define problems
- Developing and using models
- Planning and carrying out investigations
- Analyzing and interpreting data
- Using mathematics and computational thinking
- Constructing explanations
- Engaging in argument from evidence
- Obtaining, evaluating and communicating information

(Next Generation Science Standards,
taken from NSTA site:
https://ngss.nsta.org/PracticesFull.aspx)

nsta
National Science Teaching Association

Active Learning might look like ...

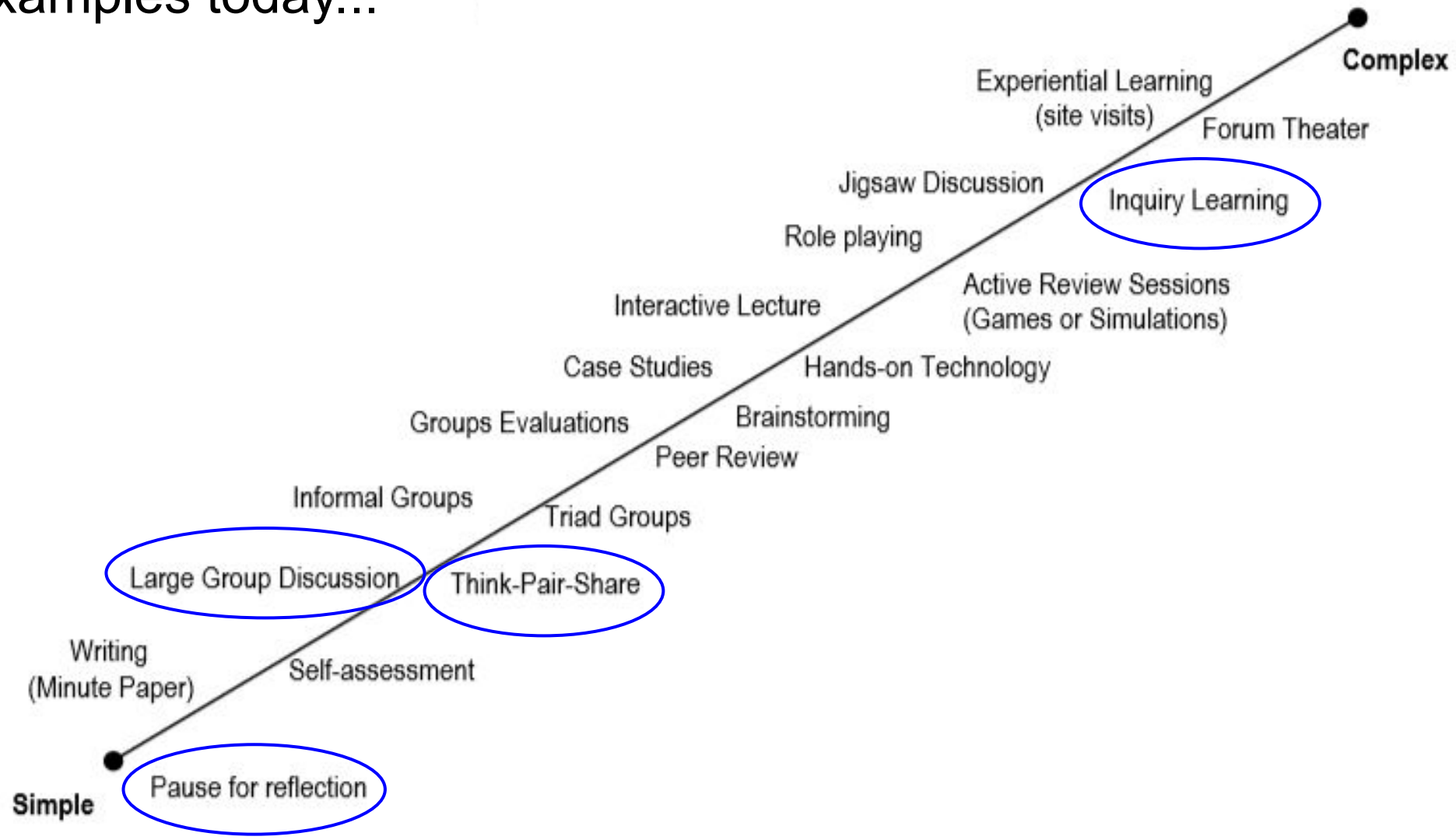


This is a spectrum of some active learning activities arranged by complexity and classroom time commitment.

Prepared by Chris O'Neal and Tershia Pinder-Grover, Center for Research on Learning and Teaching, University of Michigan

http://crlt.umich.edu/sites/default/files/Active_Learning_Continuum_CRLT.pdf

A few examples today...



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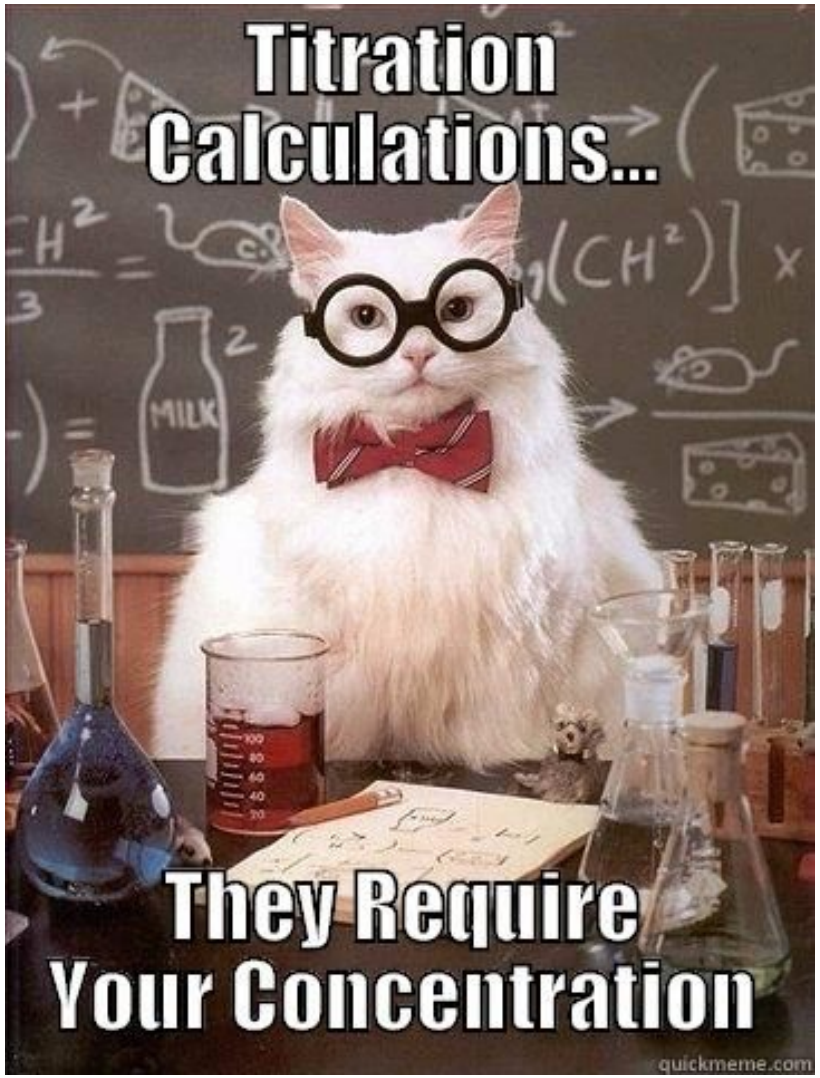
Lesson: Acid-Base Titration Investigation

(You are playing the part of your favorite student)

Lesson Outcomes:

- Apply solution stoichiometry and equilibrium concepts to pH calculations
- Predict pH values given titration volume data
- Work collaboratively to create a class graph and to check predictions



Worksheet Part I - Instructions

- Active Learning Strategy: **Think-Pair-Share**
- Logistics:
  - Breakout rooms (groups of 2 – 3)
  - If your partners are duds (technology issues, etc.), just come back to the main room and we will re-assign you
  - Access the worksheet via Google docs - **link to Google doc Worksheet in the chat**
  - Discuss answers (*verbally*) Part I - Think before you Calculate
- Time for this activity: 8 minutes (will send 1 minute warning message)

Acid-Base Titration Investigation

Purpose:

In this class activity, you and your group will use your knowledge of solution stoichiometry and equilibrium reactions to predict the consequences of an acid-base reaction by calculating pH values along a titration curve.

Tasks:

1. Complete Part I of this worksheet as a "Think-Pair-Share" exercise.
   a. **Think** (individually) about your answers to the questions.
   b. **Pair** up with a classmate in a breakout room.
   c. **Share** your answers with each other. Reconcile any differences you may have by convincing each other which answers are correct.
   d. When you are done, **return to the main Zoom room**.
2. Complete Part II of this worksheet by collaborating on a Google Sheet.
3. Complete Part III of this worksheet before our next class session.

Part I: Think Before You Calculate

Consider the following experiment: **15.00 mL** of **0.600 M** acetic acid, $HC_2H_3O_2$ (K_a = **1.8×10^{-5}**), are titrated with **0.500 M** sodium hydroxide, NaOH.

1. Identify the substance being titrated (aka, the "*analyte*"): _____
   a. Is this substance an acid or a base? _____
   b. Is it strong or weak?_____
      What evidence do you have to support your claim?
   c. Without doing any calculations at this point, make an estimate of the pH of the analyte solution itself, before beginning the titration. _____
2. Identify the titrant. (i.e., What is your substance above being titrated with?): _____
3. As the titrant is added to the analyte, predict what will happen to the pH. Describe the expected trend.
4. How would you calculate the initial pH? (You don't have to calculate this value right now, just describe how you *would* do it if you needed to.)

Debrief Think-Pair-Share:

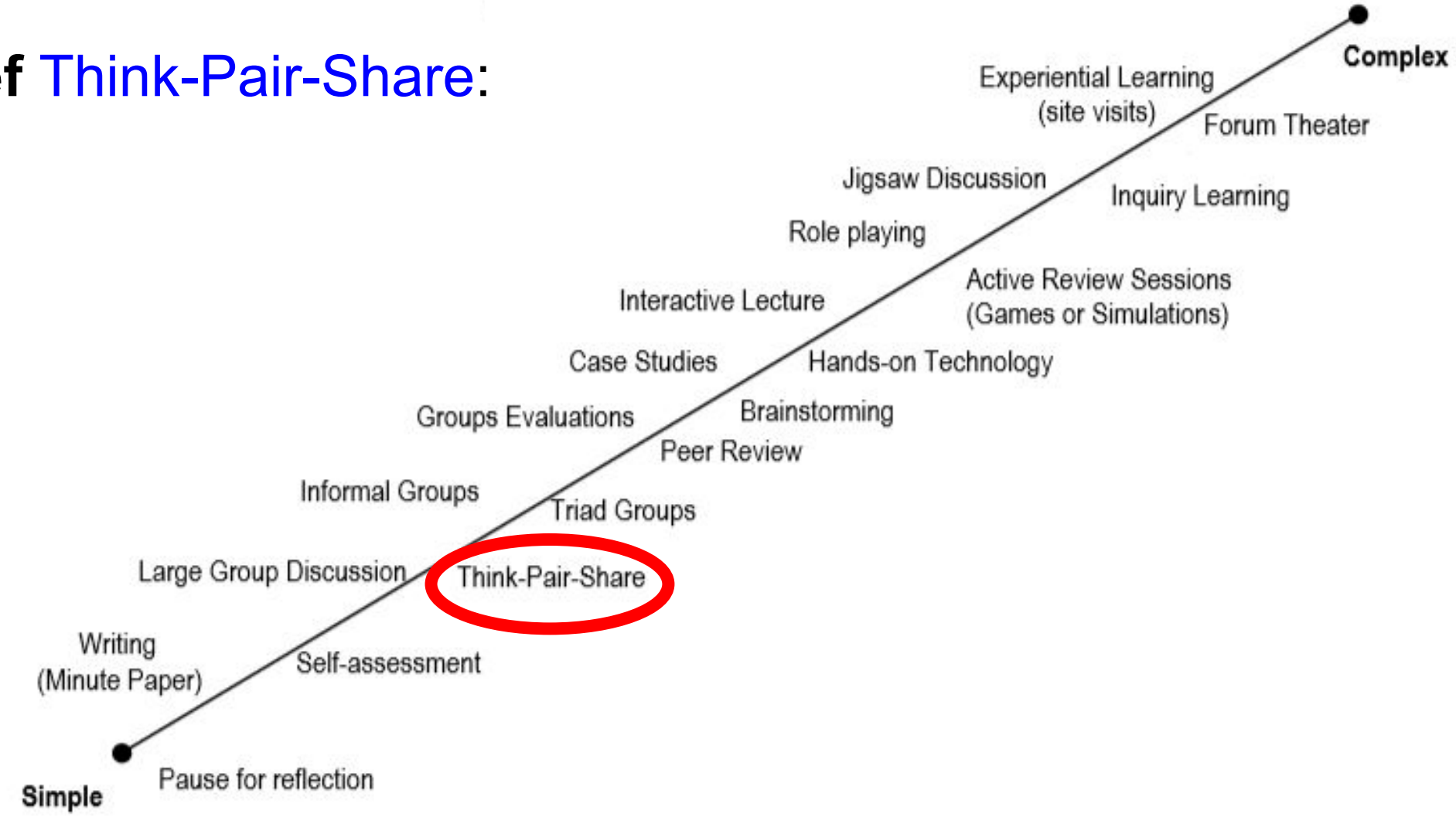
Level of teacher preparation?

Level of student engagement?

Ease of student engagement?

Information acquired by the instructor?

Debrief Think-Pair-Share:



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Debrief Think-Pair-Share:

Level of teacher preparation?

Level of student engagement?

Ease of student engagement?

Information acquired by the instructor?

Worksheet **Part II** - Instructions

- Active Learning Strategy: **Inquiry Learning (using a worksheet)**
- Logistics
  - You are assigned to a breakout room (4-5). Note your <u>Room number</u> before join the group.
  - The link to a Google "Titration Activity" folder has just been added to the chat.
  - Open the link or copy the url.
  - Open the document for your breakout room number - Rm#___

Worksheet **Part II** - Instructions

- Active Learning Strategy: **Inquiry Learning (using a worksheet)**
- Logistics
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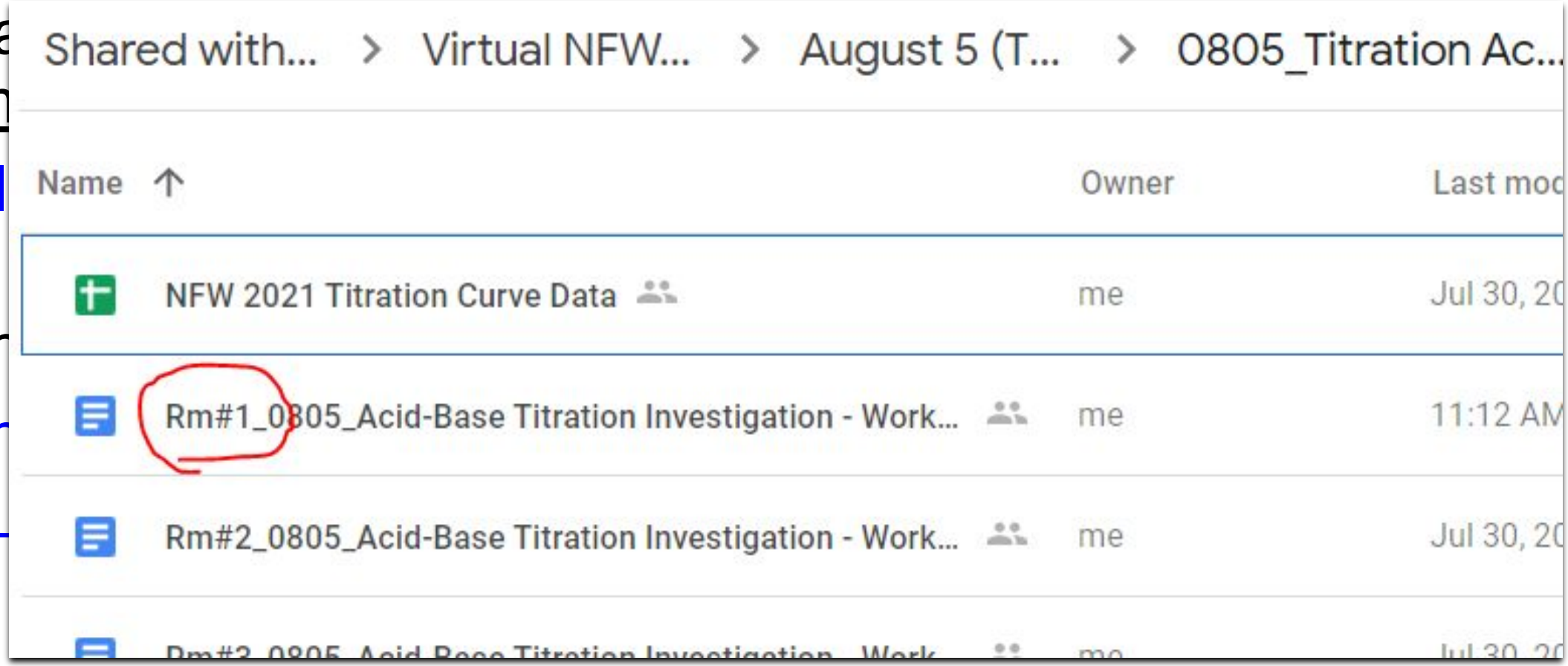
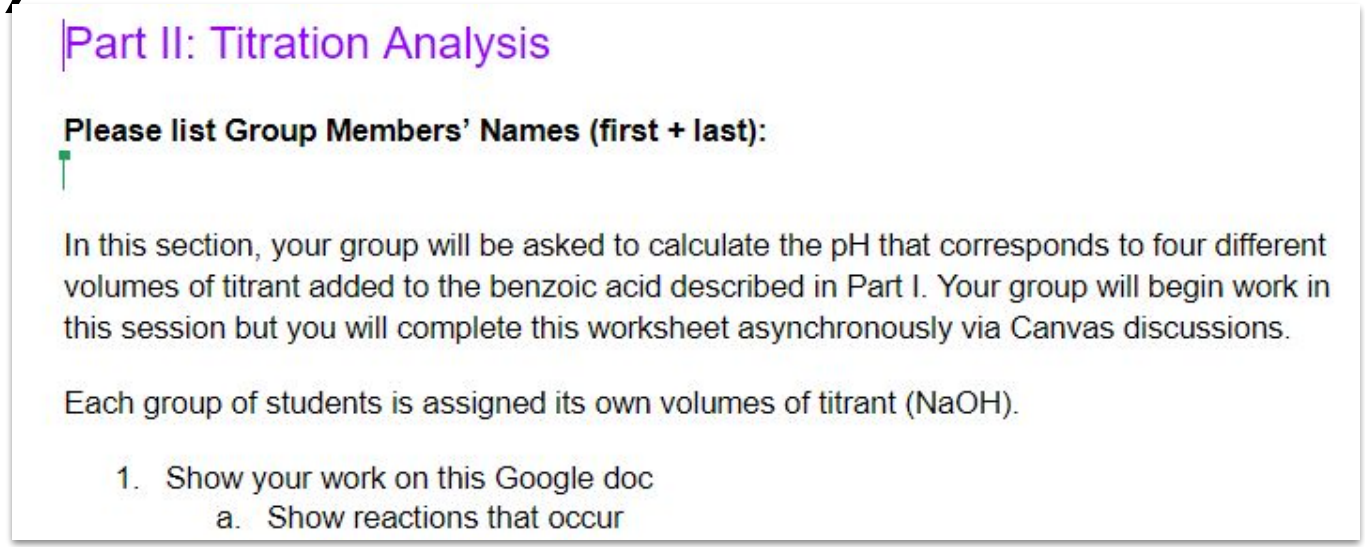


Instructions (cont'd):

- For worksheet **Part II**
  - Write your names in Part II



Part II: Titration Analysis

Please list Group Members' Names (first + last):

In this section, your group will be asked to calculate the pH that corresponds to four different volumes of titrant added to the benzoic acid described in Part I. Your group will begin work in this session but you will complete this worksheet asynchronously via Canvas discussions.

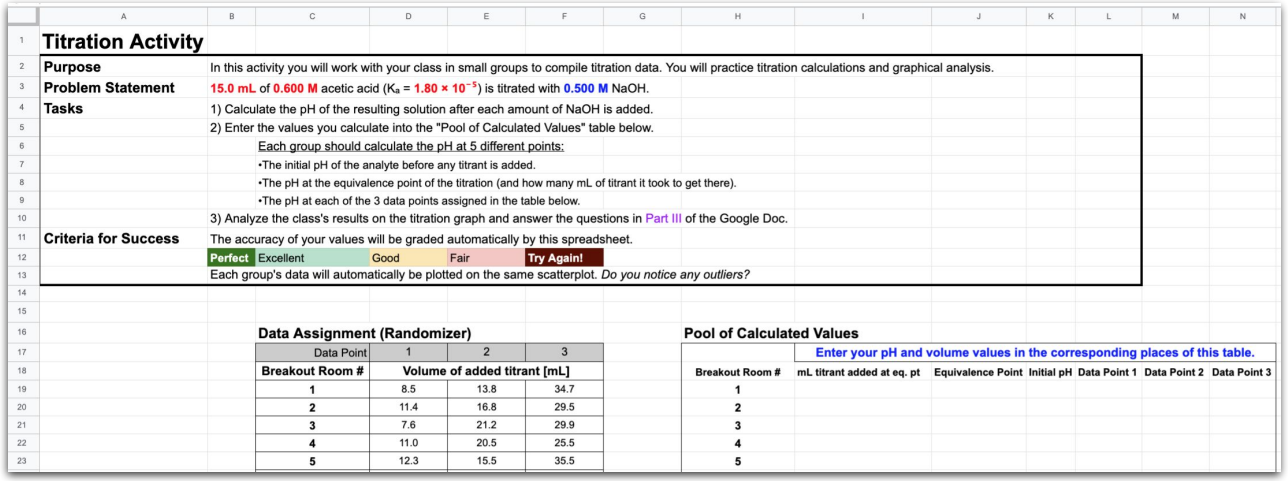
Each group of students is assigned its own volumes of titrant (NaOH).

1. Show your work on this Google doc
   a. Show reactions that occur

- Your group is going to work collaboratively on your single assigned document in the folder (Google doc).

Instructions (cont'd):

- For worksheet **Part II**
  - Work problem IIA together and **post result** in the shared class data Excel Google sheet (link is in your Google doc and in chat)



Titration Activity

Purpose	In this activity you will work with your class in small groups to compile titration data. You will practice titration calculations and graphical analysis.
Problem Statement	15.0 mL of 0.600 M acetic acid (K_a = 1.80×10^{-5}) is titrated with 0.500 M NaOH.
Tasks	1) Calculate the pH of the resulting solution after each amount of NaOH is added. 2) Enter the values you calculate into the "Pool of Calculated Values" table below. Each group should calculate the pH at 5 different points: •The initial pH of the analyte before any titrant is added. •The pH at the equivalence point of the titration (and how many mL of titrant it took to get there). •The pH at each of the 3 data points assigned in the table below. 3) Analyze the class's results on the titration graph and answer the questions in Part III of the Google Doc.
Criteria for Success	The accuracy of your values will be graded automatically by this spreadsheet. Perfect Excellent Good Fair Try Again! Each group's data will automatically be plotted on the same scatterplot. *Do you notice any outliers?*

Data Assignment (Randomizer)

Data Point	1	2	3
Breakout Room #	**Volume of added titrant [mL]**		
1	8.5	13.8	34.7
2	11.4	16.8	29.5
3	7.6	21.2	29.9
4	11.0	20.5	25.5
5	12.3	15.5	35.5

Pool of Calculated Values

Enter your pH and volume values in the corresponding places of this table.

Breakout Room #	mL titrant added at eq. pt	Equivalence Point	Initial pH	Data Point 1	Data Point 2	Data Point 3
1						
2						
3						
4						
5						

- Assign the remaining questions based on birthday month, from earliest to latest. Each group member works on a different question (IIB - IIE) on your group's Google doc

Instructions (cont'd):

For **Part II** - Assigning Roles:

- the person with the earliest birth month will be the record keeper (share Google doc).
- The latest birth month will be the reporter (confirm results are posted on Google Sheet).
- The person with the middle birth months will be the timekeepers (keep group on task).

Part II - calculations

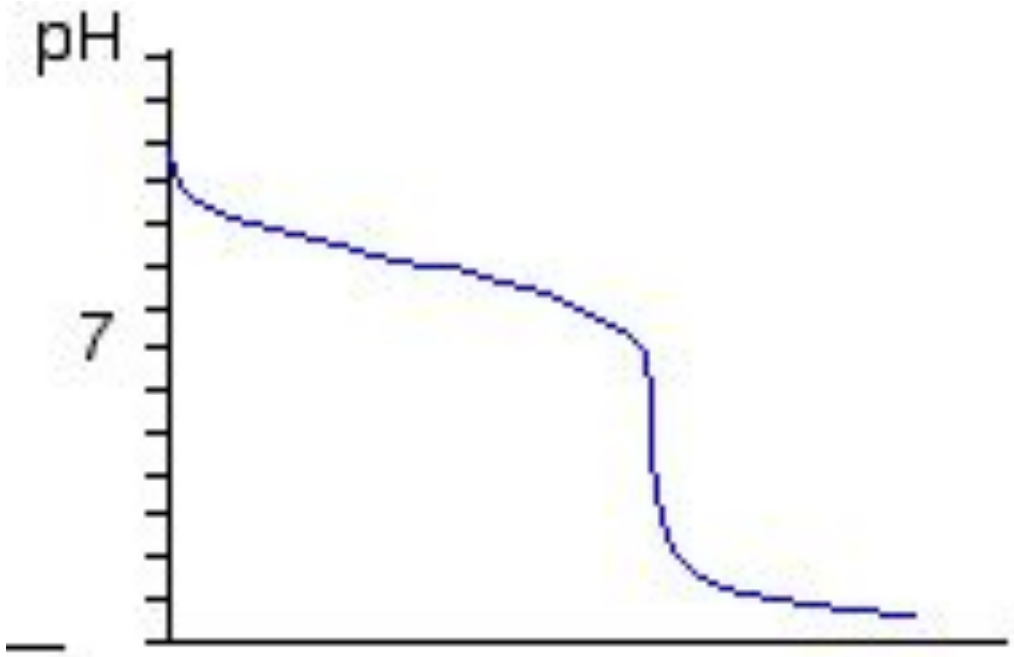
- Bring group back together in the middle of the work
  - **Address whole class questions**
  - Encourage students to discuss their approach
- Branch point
  - Go back to break out rooms to put it all together for part 2
  - Finish asynchronously (Part II & III) – using discussion features in Canvas Learning Management System.

- The reporter is responsible for posting the group's data in the provided Google sheet.

Assessment – move to asynchronous portion

What type of titration is represented by the graph shown?

a. Strong acid with strong base
b. Weak acid with strong base
c. Weak base with strong acid
d. Strong base with strong acid



How would the activity look in an asynchronous class?

- Create or assign groups using your LMS
- Deliver clear instructions on how the work should be divided
- Use Google docs or other collaborative platform for record keeping and submission
- Use discussion boards for questions, clarifications and follow up

Canvas - asynchronous lesson

Invitation to Canvas NFW Course sent last night

- Follow the link
- Tips in an email also sent last night

You've been invited to participate in a class at Free For Teacher. The class is called 2021 NFW - Active Learning Strategies. Course role: Student

Name: **Grub**

Email: **theharbols@frontier.com**

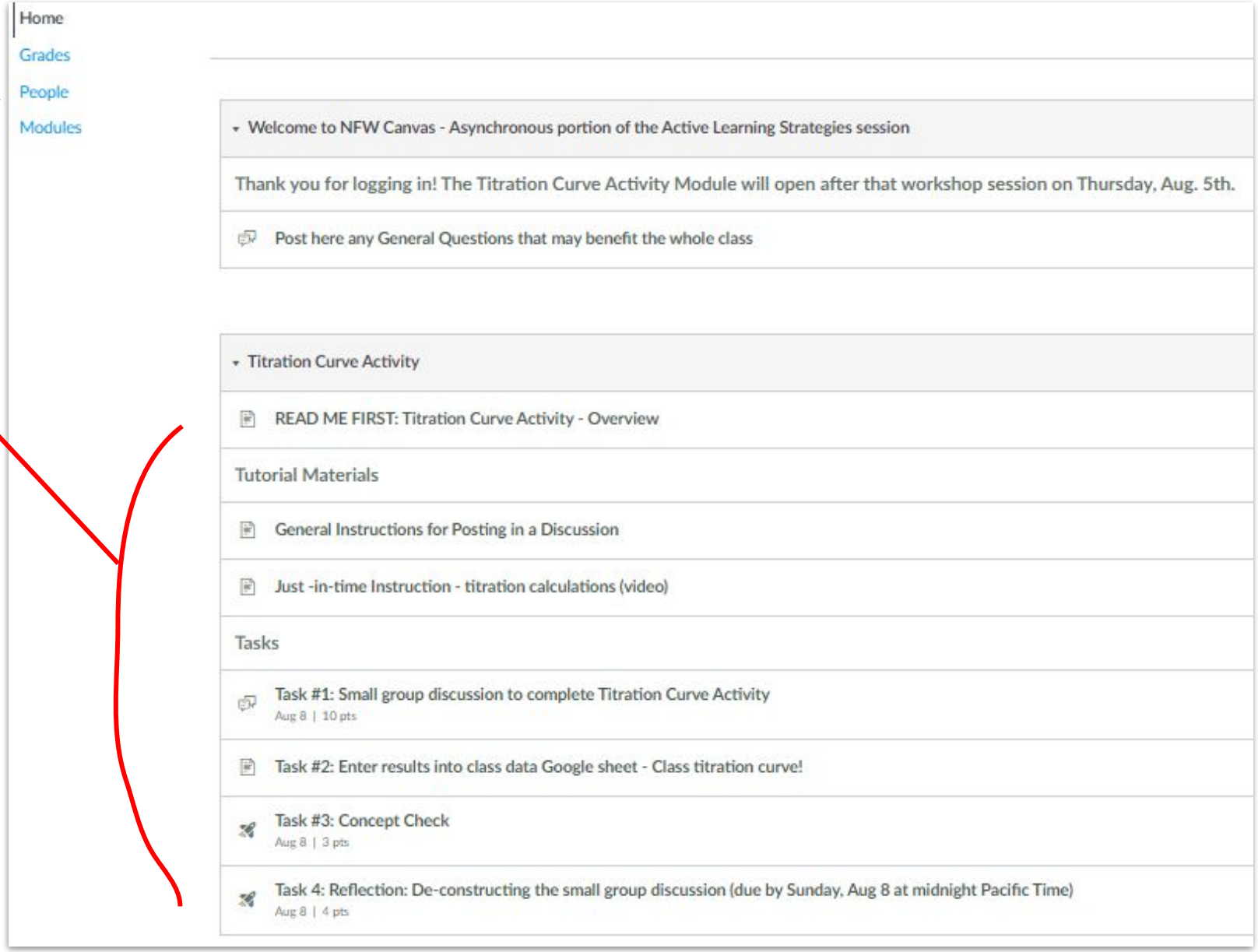
Username: **none**

You'll need to register with Canvas before you can participate in the class.

Get Started

Canvas - asynchronous

- Restricted navigation
- Access all content through Activity Module
- Finish Canvas Activity Tasks #1 - 4 Thursday - Sunday evening
- Comparison on Monday (10 minute review)



Debrief Inquiry Learning:

Individually, consider these questions (in your head)

Assignment:
How did the worksheet promote active learning?

Ease of student engagement?
(*accessibility and inclusion*)

How did we encourage Engagement & Collaboration ?

Information acquired by the instructor?
(How do we know students learned it?)

Debrief the Debrief

- Active Learning Strategy: **Pause for Reflection**
  - *We actually stopped talking and sat in the (uncomfortable) silence*
  - *This is active - can be followed up with written submission*

Debrief Inquiry Learning:

Assignment:
How did the worksheet promote active learning?

Debrief Inquiry Learning:

Scientific Practices are inherently active

Assignment:
How did the worksheet promote active learning?

The Scientific Practices provide template for Active Learning

- Asking questions and Define problems
- Developing and using models (Parts I and II - develop mathematical model)
- Planning and carrying out investigations
- Analyzing and interpreting data (Parts I, II, and III)
- Using mathematics and computational thinking (Part II)
- Constructing explanations (Part III)
- Engaging in argument from evidence (Parts I and III)
- Obtaining, evaluating and communicating information (all Parts)

(Next Generation Science Standards,taken from NSTA site: https://ngss.nsta.org/PracticesFull.aspx)

Debrief Inquiry Learning:

Ease of student engagement? (*accessibility and inclusion*)

Debrief Inquiry Learning:

Ease of student engagement? (*accessibility and inclusion*)

- Order of the questions (everyone can engage to start)
- Different levels of questions - need everyone's input
- Roles for group members

Debrief Inquiry Learning:

How did we encourage Engagement & Collaboration ?

Debrief Inquiry Learning:

How did we encourage Engagement & Collaboration ?

- Limit materials
- Assigned student Roles
- Grouping - small groups

Debrief Inquiry Learning:

Information acquired by the instructor? (*How do we know students learned it?*)

Debrief Inquiry Learning:

- Artifact of worksheet and class titration curve
- Group report-outs
- Formative assessment question(s)

Information acquired by the instructor? (*How do we know students learned it?*)

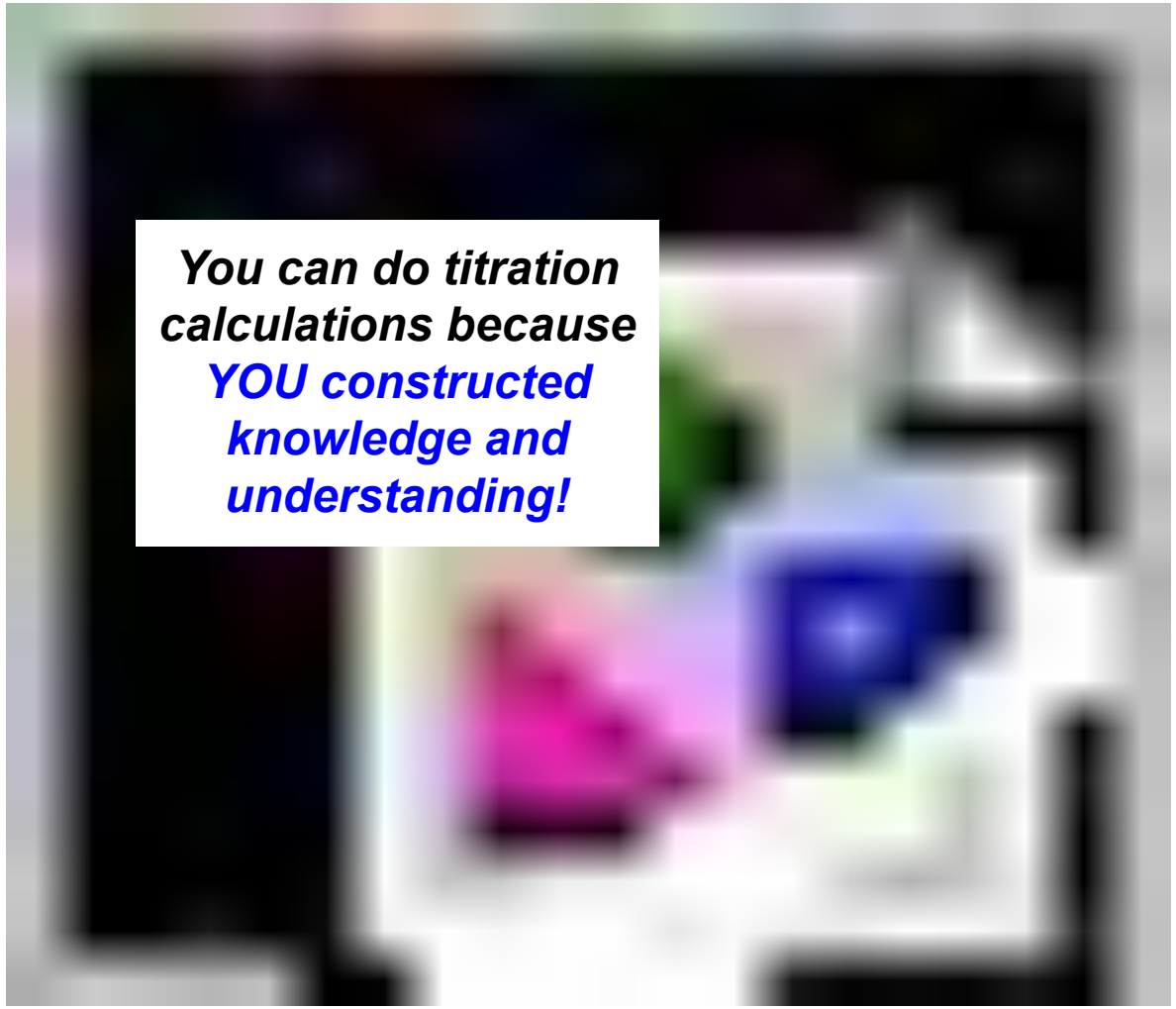
(Debrief cont'd)

What about the instructor??

(Debrief cont'd)

What about the instructor??

- Instructor as facilitator
- *What is the instructor doing?*



What about the instructor??

- Instructor as facilitator
- *What is the instructor doing?*
  - Being present
    - Visiting breakout rooms
    - Be sure everyone has mic on
    - Asking questions - maybe directed so as to invite someone who has not spoken
  - Facilitating
    - Clear communication
    - before - preparation of materials; planning
    - during - interacting & assessing; Just-in-Time instruction
    - after - assessing and closing the loop

Admonitions: *Think about Teachable Tidbit!*

- Active learning takes time
- May need to make choices of what content requires support in-class
- Content and purpose drive the activity type
- Refer to Scientific Practices

Also Consider:

- Your classroom environment (synchronous vs. asynchronous)
- Your style (stretch your comfort zone??)
- Your content/competency/skill/etc.
- Available technology (high tech/ low tech)
- Need Inspiration?
  Peers; workshops; Journals (Chem Ed); literature resources

Thanks for doing active learning with us!

We...

- Explored active-learning strategies
- Dissected a lesson
- Continue -- adaptation for **asynchronous** teaching & learning (**Canvas**)
- Planted the seed to incorporate an active-learning experience in our own lessons - Teachable Tidbit