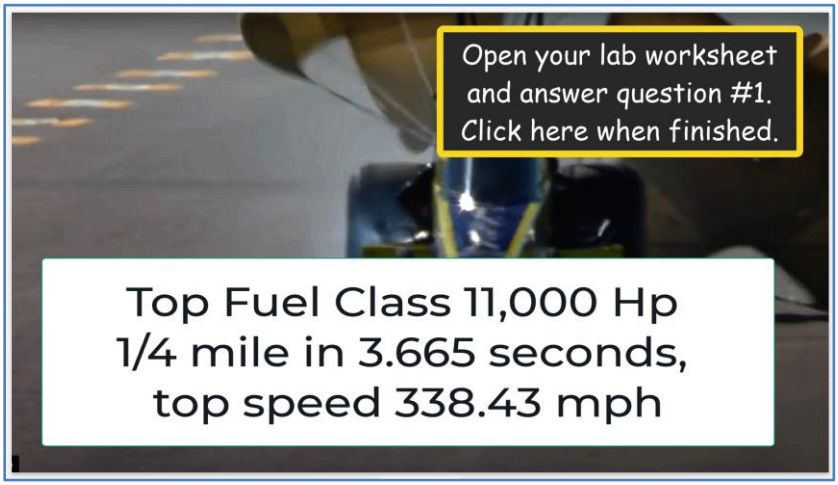
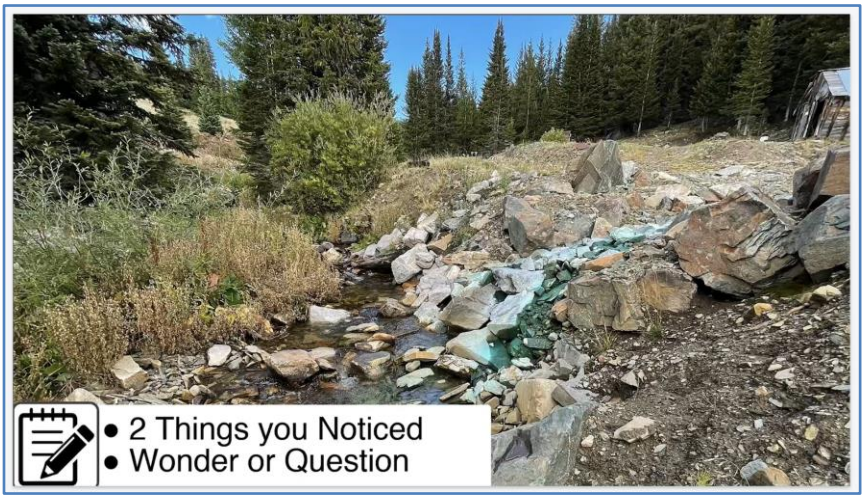




Guide to creating **Digital Lab Experiences for Students**

Exceptionally high levels of chronic absenteeism are being reported across the country. According to the US Department of Education, 66% of enrolled students had high or extreme levels of absenteeism in 2021-2022[1]. This was an increase of 25% compared to the years before the Covid-19 pandemic[2]. We were seeing similar rates in our district.

Students may be absent due to illness, sports and extracurricular activities, transportation, school closures, and family or community obligations. In addressing this, we approached this project through a lens that students want to learn, and by providing more access to science experiences, we can reach and engage more students, even when they cannot be at school in person.

Table of Contents

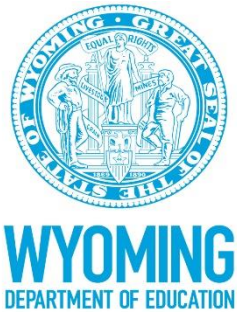
[1]Blad, Evie (2023, October 12). *High Absenteeism hits more schools, affecting students with strong attendance, too*. Education Week. https://www.edweek.org/leadership/high-absenteeism-hits-more-schools-affecting-students-with-strong-attendance-too/2023/10#:~:text=A%20student%20is%20deemed%20chronically,the%20most%20recent%20school%20year

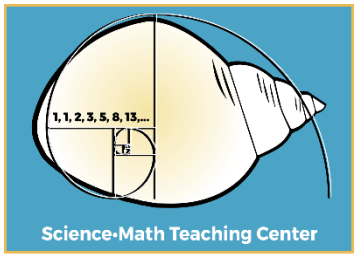
[2]Cheng, H., Balfanz, R., & Byrnes, V. (2023, October 12). *Rising Tide of Chronic Absence Challenges Schools*. Attendance Works. https://www.attendanceworks.org/rising-tide-of-chronic-absense-challenges-schools/?preview=true

Acknowledgements

This guide was the result of a multi-year project focused on supporting students in experiencing productive, rich science lab experiences despite absence from class. This project brought together science education experts, an experienced videographer, and the secondary science teachers in a rural school district that experienced high absenteeism across its three secondary schools located in three small towns. Together, this team learned how to authentically incorporate the three dimensions of science learning, as outlined in *A Framework for K-12 Science Education* (NRC, 2012), and locally relevant phenomena into virtual experiences that could be accessed outside of the classroom. These activities were also designed to parallel those occurring in the classroom.

This collaboration was made possible by the Wyoming Department of Education. This project was funded through the Wyoming Department of Education as part of the Elementary and Secondary School Emergency Relief Fund FAIN# S425D210051. It was created for and by Carbon County School Districts #2 and supported by the University of Wyoming's Science and Mathematics Teaching Center.





Celebrating *50 Years* of Excellence
at the University of Wyoming
1970-2020

Getting started

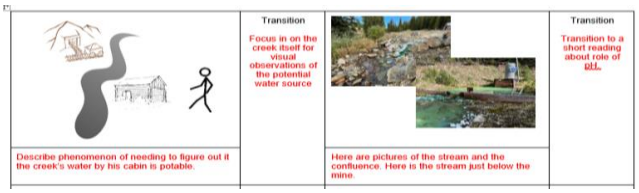
Our digital lab creation journey was rooted in several instructional practices that we aim to use in our classrooms:

- **Phenomena**: intriguing, observable events that students could make sense of as they engaged in the science practices to learn about science ideas.
- **Relevancy**: using phenomena that would intrigue *our* students
- **Three-dimensional integration**: having students approach a phenomenon through the lens of a crosscutting concept (e.g., patterns, systems & system models) while engaging in science practices to learn about our target science content. It was important to us that students were engaging in these dimensions in integrated, rather than isolated ways.

We found it effective to spend time identifying labs within lab-heavy courses that are challenging for students to make-up or are cornerstones for a unit of instruction. We also considered labs connected to priority standards and labs that did not already have effective online simulations. Start small and have fun with it!

> *"For me to get started, the labs that I targeted were mainly physical science ones. For me, that class is the most lab-heavy, and therefore, requires the most make-up time with students. After that, I checked our power standards and district assessments to find a lab that aligned with those. My next step was to check out PHET and gizmos to see if they already had something that was rigorous and effective because I did not want to reinvent the wheel. PHET has simulations, but it can be challenging and time-consuming to find appropriate student-facing documents. Last, I wanted a lab that would be easy and that I was comfortable doing for my first few times in front of the camera."*
>
> - *Laura Sanches, MS science teacher*

Creating a digital lab for students



Steps for storyboarding your digital lab

1. ***Standards:*** Identify the intended outcomes for the lab. Make sure to include the specific 3-dimensions (3Ds) you want to target.
    a. *Consider labs that are heavy hitters in your course and/or are challenging to setup again or leave up for when students return.*
2. ***Phenomenon***: Identify a phenomenon that will allow students to engage in your outcomes (content, practices, and crosscutting concepts)
    a. *Consider what may be happening in your local area that can build relevance for your students. Ask yourself: Why do these ideas matter to my students?*
3. Write a **final explanation** for your phenomenon that includes connections to all outcomes (i.e., the end product you want students to create, aligned to your target 3Ds)
4. ***Data/Tools:*** Identify what data/tools students need to use to meet your outcomes. Are there any skills you want to promote (e.g., reading a graduated cylinder)?
5. ***Check For Understanding:*** Identify your embedded checks for understanding (for the student guide). This will help you determine when to pause the video and what prompts you might want to embed in the video.
    a. *<u>WHEN</u> do you want students to engage in questioning, analysis, explanation, modeling, etc.?*
    b. *<u>WHAT</u> do you want them to do at those times?*
    c. *<u>HOW</u> do you want them to do that (e.g., model, write an explanation, create a graph, etc.)?*
6. **Evaluate** your storyboard using the **Gotta-have-it checklist** (page 7).

Creating student-facing documents

To accompany your video, identify the student-facing documents you need to support student learning.

Student Guide for the video lab: Consider the following ideas for pieces to include in your student-facing document:

- Develop an introduction of the phenomenon and a driving question
- Make sure the driving question makes sense (Ask yourself: Why would my students care about this?) and connects to the phenomenon.
- Include sensemaking opportunities such as:
    - Making observations/initial claims
    - Recording data
    - Analyzing and/or interpreting data
    - Developing and/or using models
    - Making evidence-based claims (CER)
    - Writing explanations
    - Applying knowledge gained to explain phenomenon
- Make sure to return to the phenomenon several times.
- Use explicit 3D terminology (e.g., What ***patterns*** did you observe? ***Develop a model*** that….)

Here are two examples of a student-facing document that could accompany a digital lab,

- ***Brad's Dilemma: Physical and chemical changes***
- ***Car races: Newton's second law***

Student survey: To get feedback from your students about the process, consider having them complete a student survey. See an example on page 10 of this guide.

Digital Labs: Gotta-have-it checklist

Structure of labs

- ❑ Includes a phenomenon - to provide:
  - ❑ An experience that is relevant, of interest, or connected to students *[Ask yourself: Why should they care?]*
  - ❑ Opportunities to use critical thinking
  - ❑ A way to apply knowledge gained from the video lab
- ❑ Includes all 3-Dimensions (DCI - content, SEP - Practices, CCC - overarching connecting ideas),
- ❑ Makes the purpose explicit - but does not give away the answers!
  - ❑ In an appropriate way for the content, context, students
  - ❑ Ideas: Big questions, purpose is to figure out phenomenon
- ❑ Includes 'checks for understanding'

Data-y

- ❑ Includes data that is *real life & relevant*
- ❑ Includes messy data
- ❑ Is not just cookbook – simply step-by-step
- ❑ Includes opportunities to **collect, analyze, and/or interpret data**
  - ❑ Ideas: Provide the data sets - including outliers; Incorporate data collection into the videos

Accessibility

- ❑ Think about visual and auditory supports. Consider colors, fonts, shapes, bias, etc.

Developing science "toolbox" (aka *skills*) (Optional)

- ❑ Do you want to embed any *skills* in the lab while they are engaging in the dimensions?

Nature of Science themes (Optional)

- □ Includes ideas of NOS (e.g., Science is a collaborative process of knowledge building; change claims as evidence changes, etc.)

Tips for recording your videos

General tips:

- Start simple! For your first video don't tackle your most difficult lab
- Consider labs with difficult set-up/break down or ones that you use most often

Script:

- Create a script of what you will say (Be sure to include script transitions that connect back to your phenomenon AND to the dimensions the lesson is targeting).
- Practice your script many times before you start filming. It feels silly, but helps a ton, and eliminates a lot of mistakes.

Clothing:

- Wear solid colors.
- If you have to re-record later, wear the same clothing, jewelry, and hair style.
- Make sure the lab equipment is in the same place.

Equipment:

- Check battery levels and sound. Video in a location with limited distractions.
- Check microphone audio levels with some "check, check" and view the clip to make sure audio is recording and not too loud or soft.
- Make sure the field of view has just your torso and head in the shot. Don't cut off the top of your head!
- If you aren't in the shot, still stay mic'd up and describe what you are doing. This will save a lot of time voicing over later.
- If you fidget with your hands a lot, the video from shot start above your hands, this tway you can still fidget without it being distracting
- Don't take down your cameras/lights until you have double-checked that your video and sound turned out okay!

When recording:

- If you make a mistake, pause for 3 seconds, and then start again with your hands on the table in the same place. This will make it easier to edit.
- Talk directly into the camera lens (not the display screen). To avoid "shifty eyes," do not look back and forth while speaking.
- It is helpful to practice using the remote for starting and stopping ahead of time. If you mess up you can more easily stop and start again.

File Management:

- Name files beginning with numbers so they will be in chronological order.
- To quickly add transitions between all clips, highlight the entire group of clips in the timeline, then click the transition button.

Student survey (entered into Google Forms)

***(NOTE:** Reading the student comments about new questions/connections is helpful in understanding the effectiveness of the lab. Reflection on how well we help make the connection is important. Students gave us really helpful feedback and suggestions on how to improve our videos.)*

1. What helped you make connections to the content of the lab?
2. Write a new question you have now after doing this lab:
3. I want to learn more about the topic… [strongly agree to strongly disagree]
4. What is something you'll remember from this lab?
5. On this assessment, I was acting like a scientist when I…
6. What I learned in this lab matters to me because... (Select all that apply)
    - It is interesting.
    - It will be useful to me in the future.
    - It is important to my everyday life/people I care about.
    - It helped me get a good grade.
    - It doesn't matter to me.
    - Others:
7. Please give us some feedback on the video formatting:

    Could you hear the sound without a problem? [Yes, No, N/A]

    Could you read everything you needed to in the video? [Yes, No, N/A]

    When the pop-ups appeared, did they stay on the screen for long enough? [Yes, No, N/A]

    Could you access and write in the documents?[Yes, No, N/A]

    Did you have any problems connecting to the links? [Yes, No, N/A]
8. With regards to your feedback above, where did you notice the problems? Please be as specific as possible. Say "I did not notice any problems" if you answered "Yes" and/or "NA" to all of the above prompts.
9. What worked really well?
10. How was this different from doing a lab in class?
11. What is one thing that would make this video lab better?

Storyboard for _____

Class: _____ ***Quarter***: _____ ***PE(s) targeted***: _____ ***CCC***: _____

SEP: _____***DCI***: _____ ***Skill (optional)***: _____

Phenomenon: _____

_____

_____

Final Explanation *[This is helpful for making sure the lab addresses the intended standards and phenomenon]*:

_____

_____

_____

_____

_____

_____

_____

_____

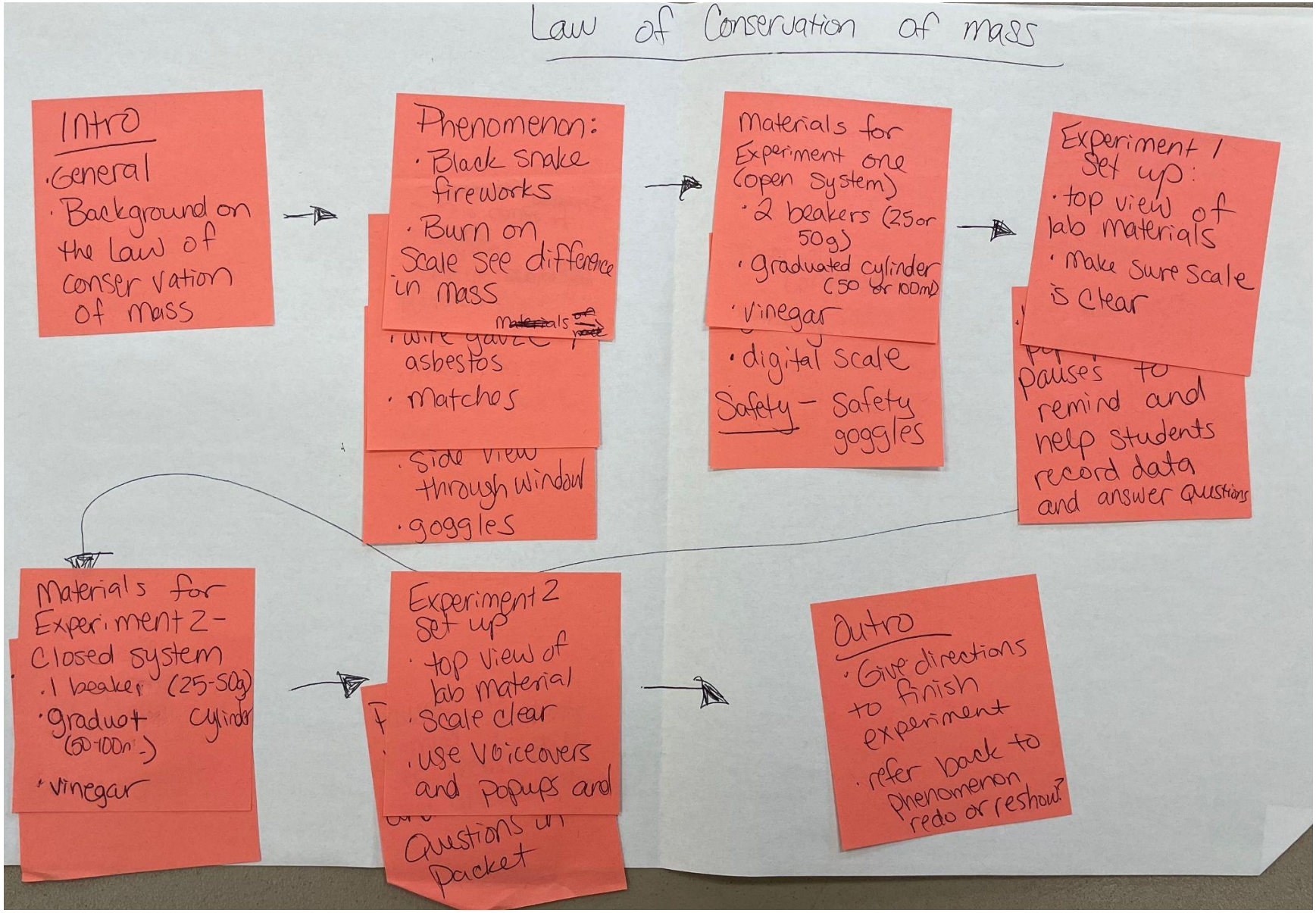
_____

Storyboard TEMPLATE [copy more as needed]

Use sticky notes to input your ideas, so they are easier to rearrange on your storyboard

	Transition [write transition here]		Transition [write transition here]
[brief explanation of scene]		[brief explanation of scene]	
	Transition [write transition here]		Transition [write transition here]
[brief explanation of scene]		[brief explanation of scene]	

Video Script (rough outline)


Law of Conservation of mass
Intro
· General
· Background on the Law of Conservation of Mass
Phenomenon:
· Black snake fireworks
· Burn on Scale see difference in Mass
asbestos
· Matches
· Side view through window
· goggles
Materials for Experiment one (open System)
· 2 beakers (25 or 50g)
· graduated cylinder (50 or 100ml)
· Vinegar
· digital scale
Safety - Safety goggles
Experiment 1 Set up:
· top view of lab materials
· Make sure Scale is clear
pauses to remind and help students record data and answer questions
Materials for Experiment 2 - Closed system
· 1 beaker (25-50g)
· graduat cylinder (50-100ml)
· vinegar
Experiment 2 set up
· top view of lab material
· Scale clear
· use voiceovers and popups and
Questions in Packet
Outro
· Give directions to finish experiment
· refer back to Phenomenon redo or reshow?