Adapting a Hands-On K-8 Science Curriculum to Remote Learning During the COVID-19 Pandemic

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mySci is a project of

Washington University in St. Louis
Institute for School Partnership

Our Program

mySci is a hands-on, inquiry-based, NGSS aligned curriculum created for and by teachers. District partners sign a contract and receive the following:

- Hands-on kits
- Professional development
- Website access to our curriculum lesson plans, assessments, slides, and other implementation materials

Washington University in St. Louis
Institute for School Partnership

mySci
inspiring the next generation of scientists

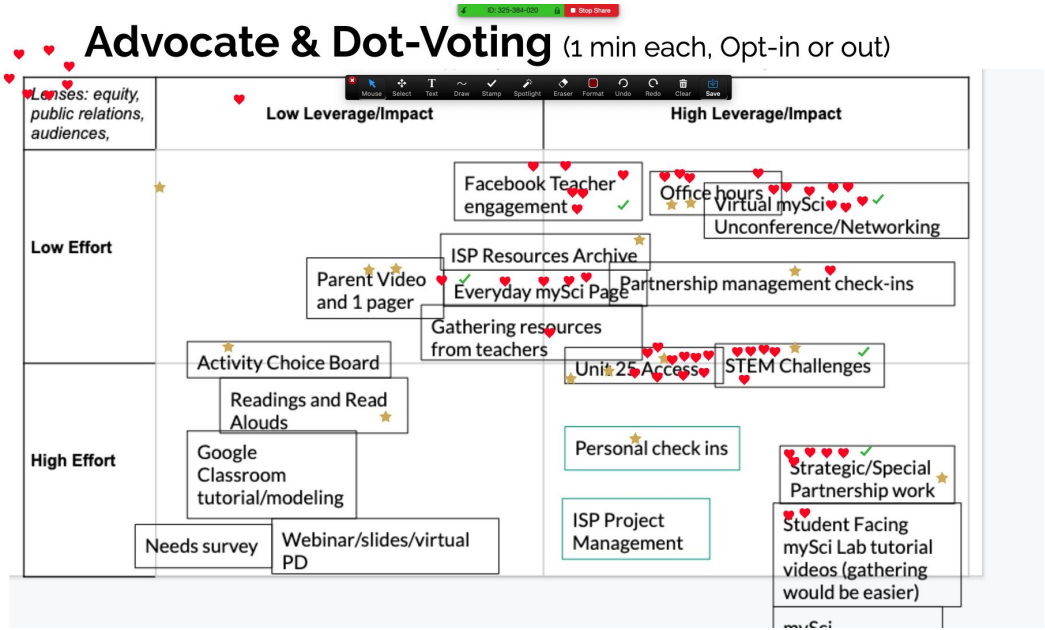
Bayer Fund

Diverse Needs of our Partners

- We serve over 4,000 K-8 science teachers in our region (over 250 schools).
- Each school has its own way of being during the pandemic- the response is not unified.
- Some children would have access to live learning, some would have access to on-demand or recorded learning.
- Some children would have iPads, some would have Chromebooks (etc).

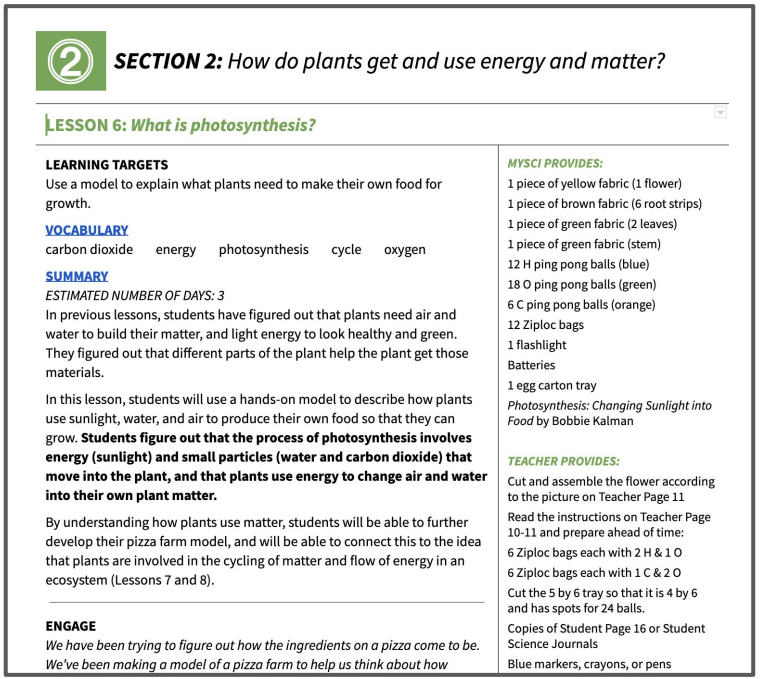
Deciding what and how to adapt

- Our institution uses principles of Improvement Science to guide our work.



How were we able to so quickly pivot?

- Our program is created using Google Docs and Google Slides that we edit frequently based on teacher feedback.



SECTION 2: *How do plants get and use energy and matter?*

LESSON 6: ***What is photosynthesis?***

LEARNING TARGETS
Use a model to explain what plants need to make their own food for growth.

VOCABULARY
carbon dioxide energy photosynthesis cycle oxygen

SUMMARY
ESTIMATED NUMBER OF DAYS: 3
In previous lessons, students have figured out that plants need air and water to build their matter, and light energy to look healthy and green. They figured out that different parts of the plant help the plant get those materials.

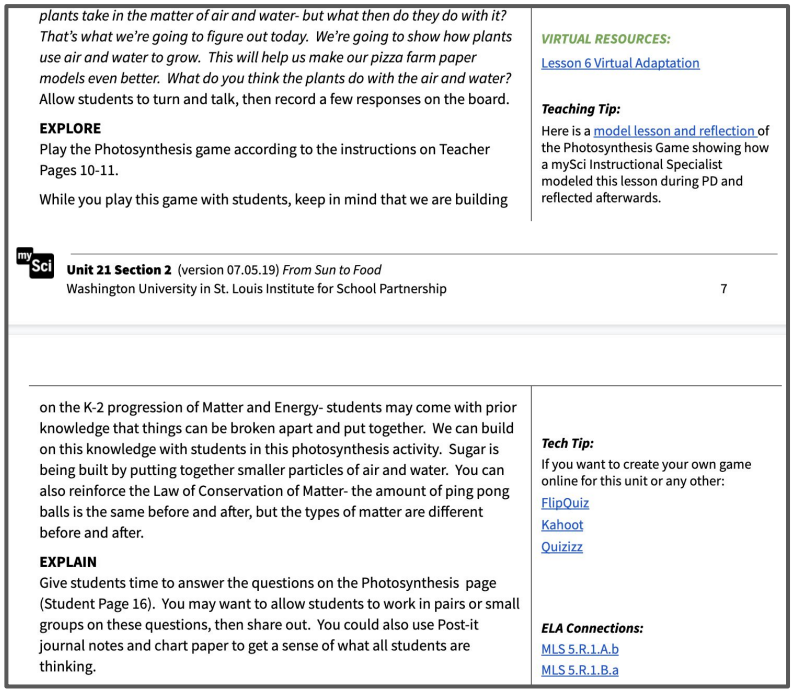
In this lesson, students will use a hands-on model to describe how plants use sunlight, water, and air to produce their own food so that they can grow. **Students figure out that the process of photosynthesis involves energy (sunlight) and small particles (water and carbon dioxide) that move into the plant, and that plants use energy to change air and water into their own plant matter.**

By understanding how plants use matter, students will be able to further develop their pizza farm model, and will be able to connect this to the idea that plants are involved in the cycling of matter and flow of energy in an ecosystem (Lessons 7 and 8).

ENGAGE
We have been trying to figure out how the ingredients on a pizza come to be. We've been making a model of a pizza farm to help us think about how

MYSCI PROVIDES:
1 piece of yellow fabric (1 flower)
1 piece of brown fabric (6 root strips)
1 piece of green fabric (2 leaves)
1 piece of green fabric (stem)
12 H ping pong balls (blue)
18 O ping pong balls (green)
6 C ping pong balls (orange)
12 Ziploc bags
1 flashlight
Batteries
1 egg carton tray
Photosynthesis: Changing Sunlight into Food by Bobbie Kalman

TEACHER PROVIDES:
Cut and assemble the flower according to the picture on Teacher Page 11
Read the instructions on Teacher Page 10-11 and prepare ahead of time:
6 Ziploc bags each with 2 H & 1 O
6 Ziploc bags each with 1 C & 2 O
Cut the 5 by 6 tray so that it is 4 by 6 and has spots for 24 balls.
Copies of Student Page 16 or Student Science Journals
Blue markers, crayons, or pens



plants take in the matter of air and water- but what then do they do with it? That's what we're going to figure out today. We're going to show how plants use air and water to grow. This will help us make our pizza farm paper models even better. What do you think the plants do with the air and water? Allow students to turn and talk, then record a few responses on the board.

EXPLORE
Play the Photosynthesis game according to the instructions on Teacher Pages 10-11.

While you play this game with students, keep in mind that we are building

VIRTUAL RESOURCES:
Lesson 6 Virtual Adaptation

Teaching Tip:
Here is a model lesson and reflection of the Photosynthesis Game showing how a mySci Instructional Specialist modeled this lesson during PD and reflected afterwards.

on the K-2 progression of Matter and Energy- students may come with prior knowledge that things can be broken apart and put together. We can build on this knowledge with students in this photosynthesis activity. Sugar is being built by putting together smaller particles of air and water. You can also reinforce the Law of Conservation of Matter- the amount of ping pong balls is the same before and after, but the types of matter are different before and after.

EXPLAIN
Give students time to answer the questions on the Photosynthesis page (Student Page 16). You may want to allow students to work in pairs or small groups on these questions, then share out. You could also use Post-it journal notes and chart paper to get a sense of what all students are thinking.

Tech Tip:
If you want to create your own game online for this unit or any other:
FlipQuiz
Kahoot
Quizizz

ELA Connections:
MLS 5.R.1.A.b
MLS 5.R.1.B.a

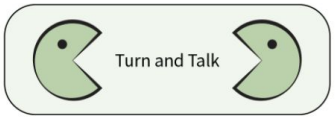
LESSON 6:

What is **photosynthesis**?

Engage

Question:

What do you think the plants do with the air and water they take in?



How do we keep the rigorous, equitable nature of NGSS instruction in a remote environment?

Criteria:

- Phenomena-based
- Student use of Science and Engineering Practices
- Equitable discourse
- Ease of student and teacher use

Program Component: Hands-On Activities

- A key component of our program involves hands-on activities that allow students to develop and use models, plan and carry out investigations, and analyze and interpret data.
- These materials are delivered in a kit that students would use in groups if school was in-person.

Virtual Adaptation

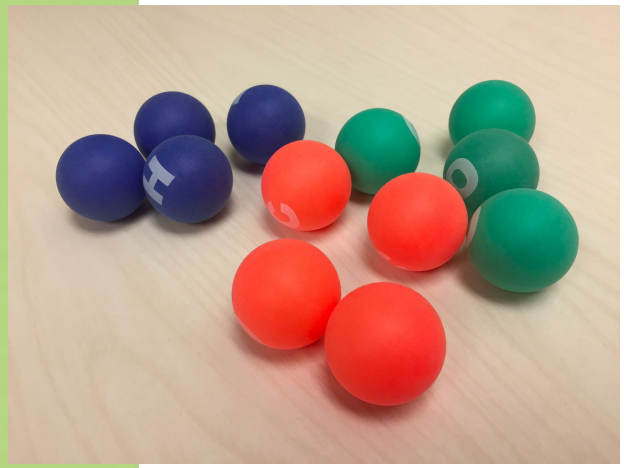
- To adapt this program component to a virtual setting, we designed:
  - Virtual labs showing how the lab would look if a student did it in-person
  - Google Slides simulations where students can click and drag Google Shapes to develop and use models

IN PERSON SLIDE AND HANDS-ON ACTIVITY

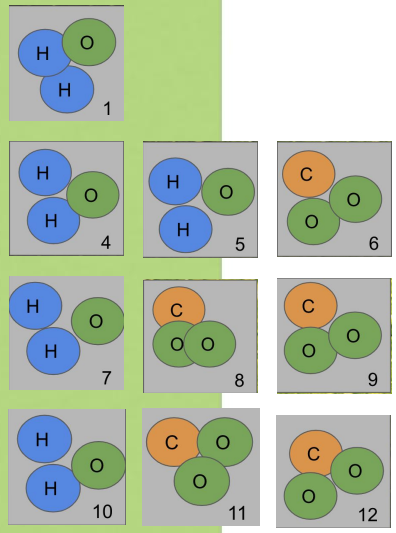
LESSON 6:

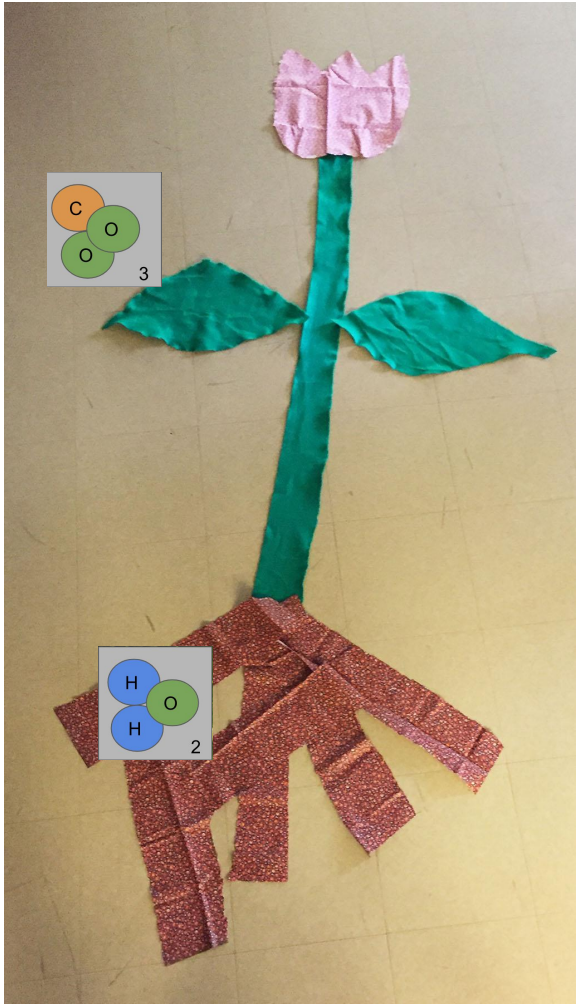
What is **photosynthesis**?

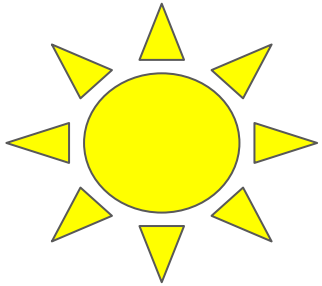
Explore



Play the **Photosynthesis** Game

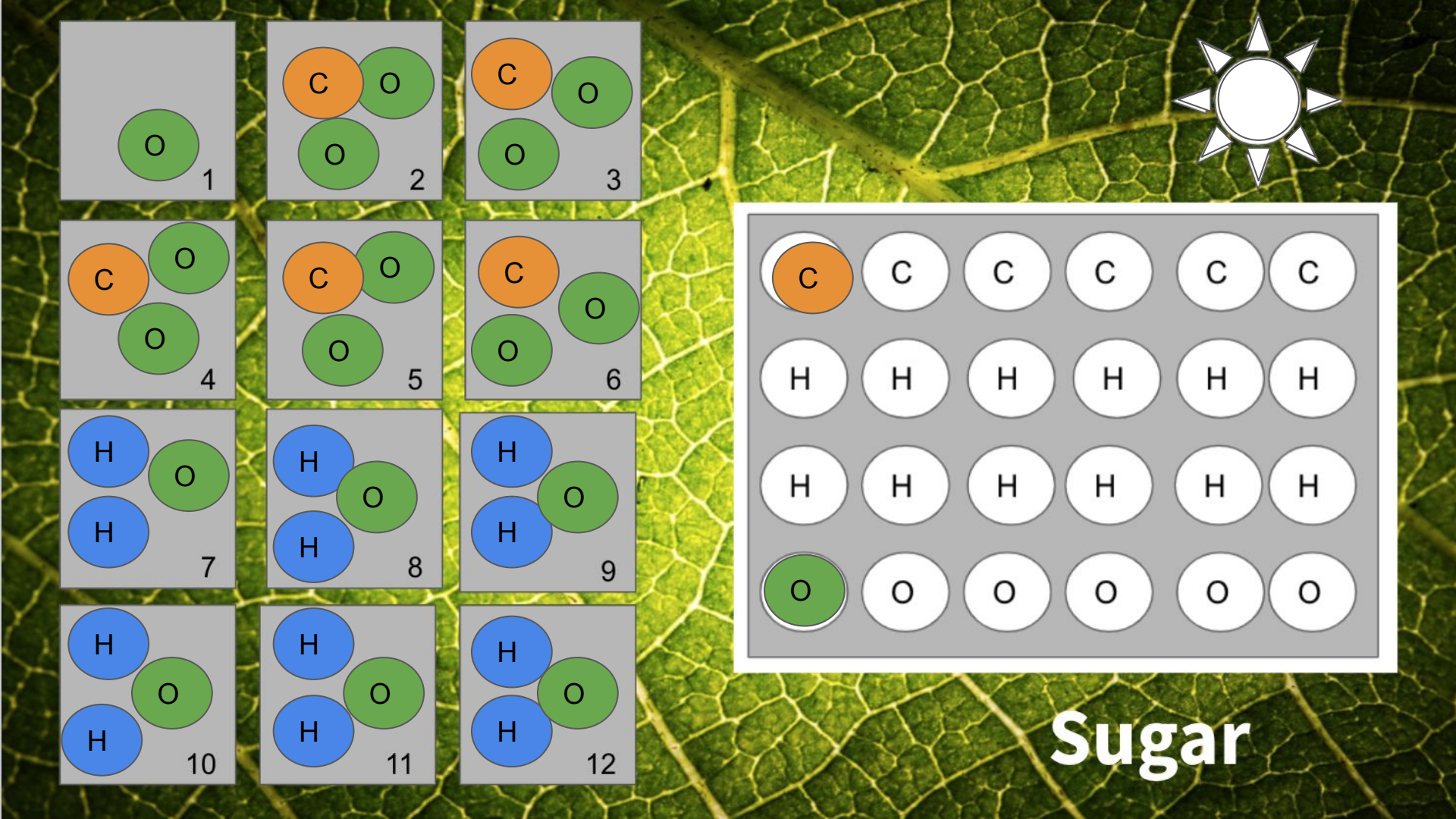






Recall the different structures of a plant and their functions.

1. Place your molecule in the location where it enters the plant.
2. Use the arrows to show the movement of matter in the plant and energy transfer.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Sugar

Program Component: Student Sensemaking

- A key component of our program involves allowing ALL students to engage in productive discussion and writing so that they can make sense of scientific phenomena.
- To accomplish this in-person, our curriculum utilizes turn and talks, small group discussion, and journal pages.

IN PERSON SLIDE AND JOURNAL PAGE

LESSON 6:

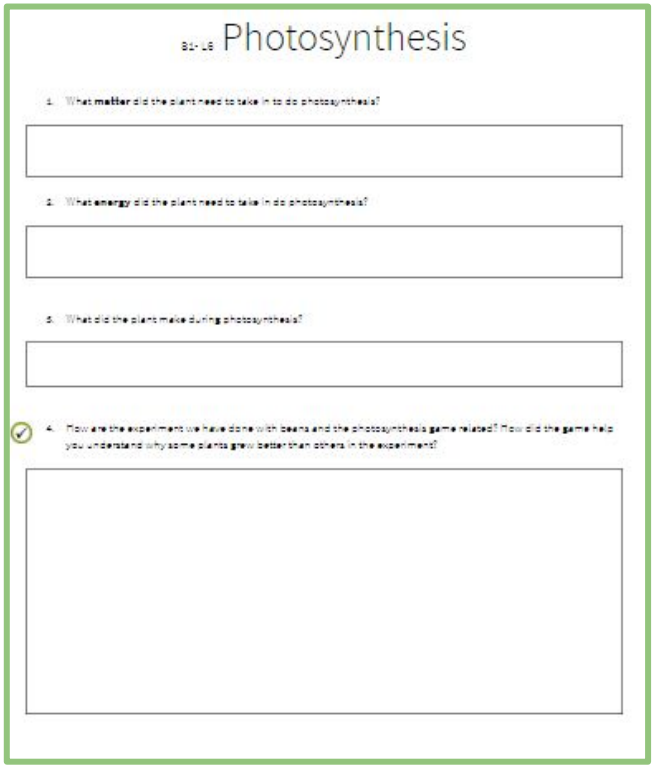
What is **photosynthesis**?

Explain

- Complete Photosynthesis page.
- Share your ideas with the class.

STUDENT PAGE 16:

Photosynthesis



Photosynthesis

1. What **matter** did the plant need to take in to do photosynthesis?

2. What **energy** did the plant need to take in do photosynthesis?

3. What did the plant make during photosynthesis?

4. How are the experiment we have done with beans and the photosynthesis game related? How did the game help you understand why some plants grew better than others in the experiment?

Virtual Adaptation

To adapt this discussion to a virtual setting, we:

- Provided individual think time to develop initial explanations.
- Incorporated breakout rooms for small group discussion.
- Added norms, group roles, and sentence stems to guide breakroom discussions.
- Led whole group discussions, in order to push student thinking.

Photosynthesis Model Reflection

1. What were the inputs and outputs of matter in the plant system?
2. What energy did the plant need to start this process?
3. What did you observe about the amount of matter in the model?
4. In real life, what happens to the oxygen that was left over?
5. Why did the beans with no water and no air grow poorly?

Individual
Think
Time

Photosynthesis Model Reflection

1. You will go to a small group breakout room to discuss five questions.
2. You will have 15 minutes to discuss these questions.
3. Choose a recorder, a timekeeper, and a reporter.
    a. Recorder: Types answers.
    b. Timekeeper: Keeps track of the 15 minutes.
    c. Reporter: Will share answers with the whole class when we get back together.

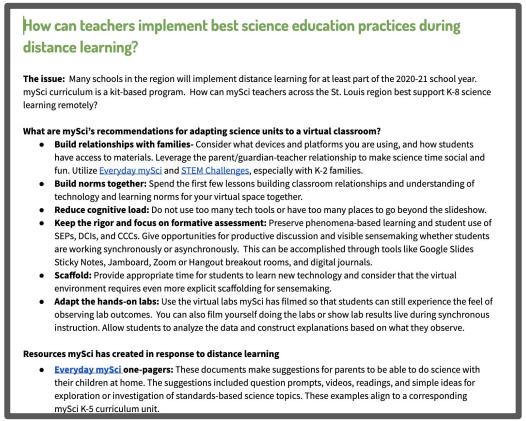
Photosynthesis Model Reflection

1. What were the inputs and outputs of matter in the plant system?
2. What energy did the plant need to start this process?
3. What did you observe about the amount of matter in the model?
4. In real life, what happens to the oxygen that was left over?
5. Why did the beans with no water and no air grow poorly?

Breakout Room 1

Disseminating the Curriculum Adaptations

- In order to communicate these adaptations, we:
  - created one-pager documents to summarize what we changed
  - added all links to our website, where teachers access our curriculum documents
  - presented the resources during professional development sessions and modeled lessons using them



How can teachers implement best science education practices during distance learning?

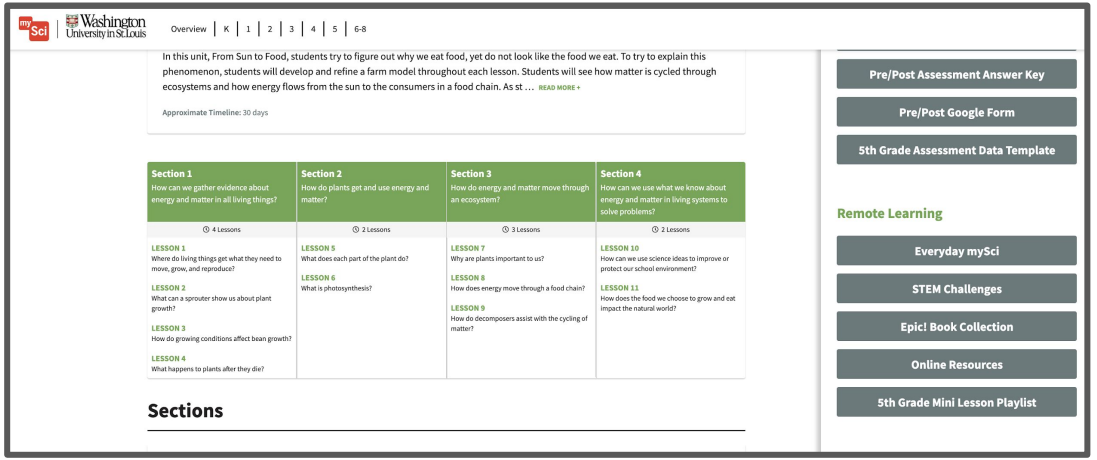
The issue: Many schools in the region will implement distance learning for at least part of the 2020-21 school year. mySci curriculum is a kit-based program. How can mySci teachers across the St. Louis region best support K-8 science learning remotely?

What are mySci's recommendations for adapting science units to a virtual classroom?

- **Build relationships with families-** Consider what devices and platforms you are using, and how students have access to materials. Leverage the parent/guardian-teacher relationship to make science time social and fun. Utilize Everyday mySci and STEM Challenges, especially with K-2 families.
- **Build norms together:** Spend the first few lessons building classroom relationships and understanding of technology and learning norms for your virtual space together.
- **Reduce cognitive load:** Do not use too many tech tools or have too many places to go beyond the slideshow.
- **Keep the rigor and focus on formative assessment:** Preserve phenomena-based learning and student use of SEPs, DCIs, and CCCs. Give opportunities for productive discussion and visible sensemaking whether students are working synchronously or asynchronously. This can be accomplished through tools like Google Slides Sticky Notes, Jamboard, Zoom or Hangout breakout rooms, and digital journals.
- **Scaffold:** Provide appropriate time for students to learn new technology and consider that the virtual environment requires even more explicit scaffolding for sensemaking.
- **Adapt the hands-on labs:** Use the virtual labs mySci has filmed so that students can still experience the feel of observing lab outcomes. You can also film yourself doing the labs or show lab results live during synchronous instruction. Allow students to analyze the data and construct explanations based on what they observe.

Resources mySci has created in response to distance learning

- Everyday mySci **one-pagers:** These documents make suggestions for parents to be able to do science with their children at home. The suggestions included question prompts, videos, readings, and simple ideas for exploration or investigation of standards-based science topics. These examples align to a corresponding mySci K-5 curriculum unit.



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Overview | K | 1 | 2 | 3 | 4 | 5 | 6-8

In this unit, From Sun to Food, students try to figure out why we eat food, yet do not look like the food we eat. To try to explain this phenomenon, students will develop and refine a farm model throughout each lesson. Students will see how matter is cycled through ecosystems and how energy flows from the sun to the consumers in a food chain. As st … READ MORE +

Approximate Timeline: 30 days

Section 1	Section 2	Section 3	Section 4
How can we gather evidence about energy and matter in all living things?	How do plants get and use energy and matter?	How do energy and matter move through an ecosystem?	How can we use what we know about energy and matter in living systems to solve problems?
4 Lessons	2 Lessons	3 Lessons	2 Lessons
LESSON 1 Where do living things get what they need to move, grow, and reproduce?	LESSON 5 What does each part of the plant do?	LESSON 7 Why are plants important to us?	LESSON 10 How can we use science ideas to improve or protect our school environment?
LESSON 2 What can a sprouter show us about plant growth?	LESSON 6 What is photosynthesis?	LESSON 8 How does energy move through a food chain?	LESSON 11 How does the food we choose to grow and eat impact the natural world?
LESSON 3 How do growing conditions affect bean growth?		LESSON 9 How do decomposers assist with the cycling of matter?	
LESSON 4 What happens to plants after they die?			

Sections

Pre/Post Assessment Answer Key

Pre/Post Google Form

5th Grade Assessment Data Template

Remote Learning

Everyday mySci

STEM Challenges

Epic! Book Collection

Online Resources

5th Grade Mini Lesson Playlist

Impact of Our Adaptations

"They made virtual learning look feasible."

– ISP professional development participant

"This is great! Other curriculums and programs are being very vague and their recommendations are just 'you may want to rethink your structure for virtual learning.' But you made videos of the lessons, STEM challenges and SO much more and really worked hard to help teachers. Thank you!"

– ISP professional development participant

"This was a super helpful session which gave me very practical tips about using MySci in a virtual environment. I don't think I necessarily grew in my knowledge of teaching science but it is EXACTLY what I needed. I really wish other curriculum companies had something like this."

– ISP professional development participant

Thank You!

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