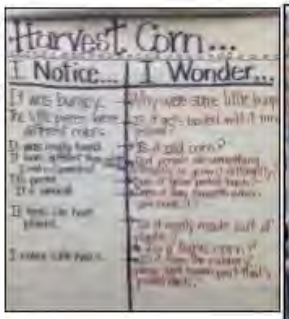
Lesson 1: Is something going to happen to this corn that got wet?

Teacher Guide

2nd Grade Unit: Why Is Our Corn Changing?

Before starting this unit.... Make sure to place 3-4 ears of Harvest corn in container with 2 cm of water (1) near a bright window inside for a few days (about 4) ahead of time . Because it takes about 7-10 days to get sprouting, pre-soaking some corn will provide you students a set of corn that they can observe today that is not yet sprouted, but that will start sprouting a couple of days later instead of many days later.

This Lesson....What we are doing now: This is the first lesson in this storyline.. Students will make observations and ask questions about what they think will happen to a decorative piece of harvest corn accidently put in water. Encourage students to generate as many ideas as possible about what they notice and wonder.

Lesson Question	Phenomena *Days of plant growth*	Lesson Performance Expectation(s)	What We Figure Out (CCCs & DCIs), *New Questions* and Next Steps
L1: Is something going to happen to this corn that got wet? (35 min) *Building toward* ⇩ *NGSS PEs:* *2-LS2-1*	 Day 1: There is some harvest corn (multiple cobs) that were accidently left outside in a box and got wet.	**Analyze data** *(Noticing)* recording observations *of the parts (structures) and properties of these parts in the harvest corn.* **Ask questions** *(Wondering)* about *the harvest corn parts (structures), their properties, their function, and what patterns of change we might see in the wet harvest corn in the future.*	Our teacher explains something that happened to a decoration (harvest orn) he/she was going to bring to class. It got left outside in a box and got wet. Our teacher was worried it was ruined and asked us what we thought, "would anything happen to it?" We passed around some of the corn that was dried off, noticed and wondered and made some predictions about both the wet and dry corn.   *We have about the harvest corn in the water:* • *Will the corn rot?* • *Will anything else happen?* *Others are questions about the dried off harvest corn:* • *If it real or fake corn?* • *What is this thing?* • *Where did it come from?* • *What is it made of?* ***Next steps: We have ideas about how we can investigate our questions:*** 1. ***We can see if anything happens to this "harvest corn submerged in the water bin" each day.*** 2. ***We can take some of the corn apart to see what it is made of, which might help us figure out if it's real corn (like we eat) or fake.***

Next Lesson....Where we're going Your students decided to watch the wet harvest corn closely to see if there are any changes. Some of the students aren't convinced this is real corn; they think it might be plastic. So next class we want to take a dry one apart.

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Getting Ready: Materials Preparation

Materials For Each Class

- Dry harvest corn (6)
- 3-4 ears of Harvest corn that have been in container with 2 cm of water for three days (1) Note: you may want to test how long the corn takes to sprout by submerging an ear of corn in water a couple weeks ahead of time, timing it (repeating the submerging of the corn) such that nothing noticeable is happening in lesson 1, but something noticeable happens by lesson 3.

Materials For Each Student

- Lesson 1 - Student Activity Sheets (1)

Safety

- None

Preparation of Materials (15 min.)

- Create blank "Notice and Wonder" chart by making a t-chart with the words "I Noticed" on one side and "This Makes Me Wonder…" on the other side.
- **Note 1:** Make sure to place 3-4 ears of Harvest corn in container with 2 cm of water (1) near a bright window inside for a few days (about 4) ahead of time . Because it takes about 7-10 days to get sprouting, pre-soaking some corn will provide you students a set of corn that they can observe today that is not yet sprouted, but that will start sprouting a couple of days later instead of many days later.
- **Note 2:** To make sure you have set up a context that represents what really happened, place a bin with a few pieces of corn outside and dump water into the bin. Then you can move the bin back inside and place it near a window in a warm location. Take 1 piece of corn out to dry off for next lesson. Make sure to keep a dry piece of harvest corn so the students can make comparisons and it serves as a control.

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Getting Ready: Teacher Preparation

Background Knowledge

- None needed

Alternative Student Conceptions

Linking Our Understanding to Scientific Terminology

- Harvest corn
- Notice & Wonder
- Prediction

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Learning Plan: Is something going to happen to this corn cob that got wet? (35 min)

1. (15 min) Begin sharing with the class that, you left this decorative harvest corn outside in a box and it got wet. You were worried that it got wet and wondered whether it was ruined or whether anything would happen to it. You brought some of it in and dried it off, but left some of it in the water because you weren't sure whether anything would happen to it.

Pass around the container of wet harvest corn and the dry harvest corn pieces, and allow your students to make observations and talk to each other in small groups about what they see. Then bring the class together for a sharing Initial Ideas and Predictions Discussion A **and ask your students what they think will happen. Record their responses in a Notice and Wonder Chart.**

Suggested Prompts:

- ➔ What do you notice about the wet harvest corn?
- ➔ What do you notice about the dry harvest corn?
- ➔ What do you think will happen to the wet harvest corn?

Listen for *student responses*, such as:

We all have different ideas about what might happen. We don't think it's real corn because it's so hard and feels like plastic. Maybe it will just plump up from the water, maybe the dye from the corn will start to leak out and stain the water, maybe it will start to rot and get stinky.

We have lots of questions! B *Some are questions like:*

Will the corn rot?
Will anything else happen?
It it real or fake corn?
What is this thing?
Where did it come from?
What is it made of?

Teacher Supports & Notes

Strategies for this Initial Ideas Discussion

A In this discussion, students should lay out the path for the activities they will engage in today. Use the prompts to ensure that students do this heavy lifting to generate ideas.

Formative Assessment Opportunities

B The practice of Asking Questions is the at the heart of this lesson. Teachers can keep track of when students are asking questions about what might happen to the corn or offering suggestions about what to do next such as, "maybe we could take pictures of the wet corn every day to see how it changes?"

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2. (10 min) Remind students that scientists keep track of their observations so that they can make comparisons later. Ask students to draw a picture of what the corn looks like today on their activity sheets so they can look back to compare later. C

3. (10 min) Use the following prompts to guide students to articulate what they figured out so far. Use the following prompts to guide this Consensus Building Discussion. D

- ➔ Are you curious to find out what might happen to the wet harvest corn?
- ➔ What have we figured out so far?

Listen for *student responses*, such as:

We figured out that we have a lot of questions about this "Harvest Corn!" We wondered if it was real, if anything will happen to it in the water, and what is it made out of? We have lots of different ideas about what might happen, and we don't all agree.

After students have shared, ask students what should we do next to figure out what's going to happen to the wet harvest corn. Use the following prompts to guide this Consensus Building Discussion.

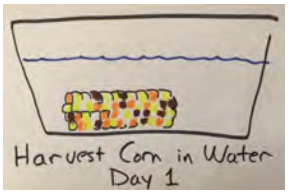
- ➔ What could we do to keep track of what happens to the wet harvest corn?
- ➔ How could we investigate some of the questions we wrote on our Notice and Wonder Chart?
- ➔ Do we have any more questions about the corn?
- ➔ What could we do to figure out what this harvest corn is made of?

Listen for *student responses* that anticipate the next step in the story line, such as

We decided to 1) See if anything happens to this "wet harvest corn" each day and 2) take some of

Classroom Artifact

C Instead of a drawing, you can take a photo with your camera phone or computer and then print a color photo of it. Label it "Day 1"



Strategies for this Consensus Building Discussion

D Just as we open the lesson in a student-centered/student-driven manner for coherence, we will close each lesson in the same way. With each lesson, students should capture what the class has figured out so far and what the class should do next. In this first lesson, students only figure out that they don't know exactly what's going to happen. Even though this is a Consensus Building discussion that doesn't mean that all students have to agree on what we think will happen to the corn. We can agree that we have different ideas about what might happen, and we all have different questions. We are now curious about the corn phenomena. The ultimate purpose of a Consensus Building discussion is to take

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the corn apart to see what it is made of, which might help us figure out if it's real (like what we eat) or fake.

As these responses are raised by students, draw attention to them, by having other students in the class restate the idea that was shared and/or explain how pursuing these investigations next time will help us answer some of our questions.

Introduce the idea of making predictions, by asking students what they think they will see for each of these two things next time. E **Have students share their predictions, and ask students how the investigations we want to do next time will help us see if these predictions are correct.**

stock of where we are with our thinking at any given moment in a unit. The class is coming to agreement, even if we simply agree the students are in different places.

Strategies for supporting students in making predictions.

E Though students won't be writing their predictions down in this first lesson, they will in subsequent lessons, so now is a good time to introduce what it means to make a prediction and how it is connected to the questions we have and investigations we are going to pursue.

Alignment With Standards

Building Toward Target NGSS PE

- **2-LS2-1.** Plan and conduct an investigation to determine if plants need sunlight and water to grow

Building Toward Common Core Standard(s)

ELA standards:

- CCSS.ELA-LITERACY.SL.2.1-Participate in collaborative conversations with diverse partners about grade 2 topics and texts with peers and adults in small and larger groups.
- CCSS.ELA-LITERACY.W.2.7- Participate in shared research and writing projects (e.g., read a number of books on a single topic to produce a report; record science observations).
- CCSS.ELA-LITERACY.W.2.8- Recall information from experiences or gather information from provided sources to answer a question.

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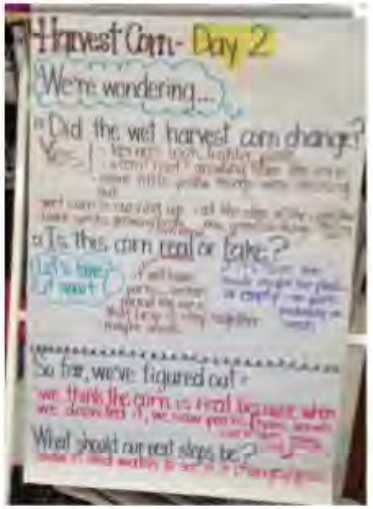
Lesson 2: What is this thing made of?

Teacher Guide

2nd Grade Unit: Why Is Our Corn Changing?

Previous Lesson....Where we've been In the last lesson, your students observed this stuff that kind of looks like corn, but seem different. They really wanted to know what it was made of so they can predict what might happen to it while it is sitting in the water.

This Lesson.... What we are doing now Students will want to figure out what this stuff is made of. You will guide them to look at the structures of the corn more closely. Encourage students to take the kernels and the cob apart, and keep track of what they notice and wonder about.

Lesson Question	Phenomena Days of plant growth	Lesson Performance Expectation(s)	What We Figure Out (CCCs & DCIs), *New Questions* and ***Next Steps***
L2: What is this thing made of? (55 min) *Building toward* ↓ *NGSS PEs: 2-LS2-1*	 Day 2: Kernels can be separated from a cob in the dry harvest corn.	**Conduct an investigation** *(Investigate)* dissecting the dry ***harvest corn*** *to determine the* ***parts*** *(structures: kernels and a cob) and properties of the structures that make it up.*	We noticed that nothing much has happened to the harvest corn placed in water so far (pattern) We conducted an investigation of something we wanted to do last time, to take the corn apart to help us see if it's real corn. In doing so, we notice: • There are some interesting **outside parts** (kernels that come off), and there are additional parts/structures like the cob. • These structures are similar to the corn we eat (patterns): both have a cob on the inside and a lot of kernels around the outside • The structures are different that the corn we eat (patterns): This stuff is much harder and not the same colors as the corn we eat. Because of some of these differences, we still aren't sure if this harvest corn is "real corn". However, we already know from 1st grade that **"all organisms have external parts"** (LS1.A, addressed in 1-LS1-1), and these external parts have some similarities so maybe it could be real corn. *We are wondering:* • *Why is it hard? Why is it shiny?* • *Is it living or nonliving?* ***Next steps: We still want to check in to see if anything happens to the harvest corn submerged in the water bin tomorrow and the next day and the next.*** 

Next Lesson....Where we're going Now that your students have decided that this stuff is probably corn, they will watch it closely to see if there are any changes to the corn submerged in the water over the next few lessons.

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Getting Ready: Materials Preparation

Materials For Each Group

- Dry harvest corn (1)
- Tray to dissect harvest corn (1)

Preparation of Materials (15 min.)

- Create a set of materials for each group of 3 students in advance.
- Post Notice and Wonder chart from previous lesson.

Materials For Each Student

- Lesson 2 - Student Activity Sheets (1)

Safety

- Remind students that cob and kernels stay in the tray

Getting Ready: Teacher Preparation

Background Information

LS1.A from the FRAMEWORK:
"All organisms have external parts."

In first grade, students were introduced to the following concepts which will be referenced in today's lesson.

- Plants are organisms.
- Examples of external parts are leaves and roots.

Alternative Student Conceptions

Students may come into this lesson thinking that the harvest corn is plastic. At the end of the dissection, students should be convinced that it's not hollow or made out of plastic. They still might be wondering if it is alive or not, even if they are convinced the corn is "real."

Linking Our Understanding to Scientific Terminology

- Cob
- Kernel

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Learning Plan: What is this thing made of? (55 min)

1. (10 min) Begin with a Consensus Building Discussion[A] to help re-orient students in the storyline. Use the following prompts to help students articulate what they figured out in the last lesson.

Suggested Prompts:

- ➔ What did we wonder about last class? (refer to "Notice and Wonder" chart)
- ➔ We had some ideas about how to investigate our questions. What were our ideas?

Listen for *student responses* that refer to what we figured out last time, such as:

We figured out that we have a lot of questions about this harvest corn! We wondered if it was real, if anything will happen to it in the water, and what is it made out of. We decided to 1) See if anything happens to this wet harvest corn each day and 2) take some of the corn apart to see what it is made of, which might help us figure out if it's real (like the corn we eat) or fake.

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2. (10 min) Next, shift to a Sharing Initial Ideas Discussion[B]. Use the following prompts to guide students to articulate what they think they should focus on in today's lesson .

Suggested Prompts:

- ➔ What do you think we could/should do to help us decide whether or not this "harvest corn" is real?
- ➔ How should we keep track of what happens to the harvest corn submerged in water today?

Teacher Supports & Notes

Strategies for this Consensus Building Discussion

A The goal of this is discussion is to reactivate the students sense that the purpose and reason we are doing this lesson today, came out of their own ideas and questions from last time. If students are struggling to remember what occurred in last class, have the harvest corn submerged in water and the Notice and Wonder chart ready to reference

Strategies for this Initial Ideas Discussion

B Invite students to generate ideas for the path of today's lesson. If students aren't sure what to do, relate the activity to something more familiar. For example, if we wanted to know whether or not a piece of fruit was real or plastic (like decoration) what could we do to figure it out?

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Listen for *student responses* that mimic the next step in the story line, such as

Because we were wondering if the corn would change now that it is in water, we should look at the corn and draw a picture of what it looks like to show if it changed from the day before. Because we wanted to know what this harvest corn is made out of, today we are going to pull it apart!

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3. (10 min) Now that students have decided the path of the lesson, gather students around the Notice and Wonder Chart C and the harvest corn submerged in the water.

Suggested Prompts:

➔ What do you notice about the wet harvest corn?

Listen for *student responses* such as:

Nothing much has happened to the harvest corn placed in water so far. Our drawings look similar to the drawings from the day before.

Remind students that scientists keep track of their observations so that they can make comparisons later. Ask students to draw a picture of what the corn looks like today in Student Activity Sheet 2.1 or in their science notebooks so we can look back to compare later.

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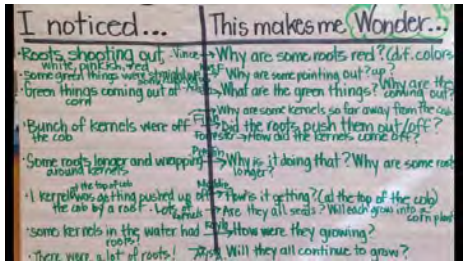
4. (10 min) Once students have had the opportunity to share their ideas on the Notice and Wonder chart and draw a picture of the corn submerged in the water bin, put students into groups of 2-3 to begin the dissection.

Suggested Prompts:

Classroom Artifact

C Example of a Notice and Wondering Chart :



Classroom Artifact

D Example of student taking the corn apart

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- ➔ When your group has your materials at your station, first take time to discuss what you notice about the harvest corn cob. Draw a picture of what you see on Student Activity Sheet 2.1. Remember, scientists always record their observations.
- ➔ Once you have made your observations, your group may begin your corn cob dissection. Remember, our goal is to figure out the answer to our question: is this corn real or fake? Do whatever you need to do to the cob to figure that out, as long as you are practicing safety and keeping the cob and any kernels that come off the on the tray at all times. D

5. (5 min) When students have completed the dissection, bring them back together as a whole group, having team members sit close to one another. In this Building Understandings Discussion E**, use the following prompts to help students debrief about their dissection.**

Suggested Prompts:

- ➔ What is one thing your group noticed about the corn before you took it apart?
- ➔ What is one thing your group noticed about the corn after you took it apart?

Listen for *student responses* such as:

Our group noticed some interesting outside parts, like kernels, and additional parts/structures, like the cob, when we took the dry corn apart. There is a cob on the inside and lot of kernels around the outside, just like the corn we eat (patterns). It is much harder and not the same colors as the corn we eat (patterns)

6. (5 min) After students have shared, revisiting the question, "What have we figured out so far?" Use the following prompts to guide this Consensus Building Discussion.

Suggested Prompts:

Strategies for this Building Understandings Discussion

E In order to involve as many students as possible in this discussion, you may want each group member to share out one noticing before the dissection and one noticing after the dissection.

If time is an issue, ask a few volunteers to share with the whole group, and allow the remaining ideas to be shared with an elbow partner.

As students share, draw attention to crosscutting concepts where possible. For example, if students reference the corn having different parts, use the terms **structure** and **function** to restate what students share. It is likely that students

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➔ What did we find out after we dissected the corn?
➔ Now that we have completed our dissection, do we think this is "real" or "fake" corn?
➔ Do we have any more questions about the corn?

Listen for *student responses* such as:

[Teacher will prompt students to think about what they learned about organisms and external parts (perhaps provide pictures as visual reminders so students can share the parts in the pictures) and encourage student responses to connect observations of corn to organisms' external parts.] We still aren't sure if this harvest corn is "real corn." However, we're pretty sure that we learned something in first grade about organisms having external parts. F *We know from 1st grade that all organisms have parts and this corn seems to have parts, so it could be real corn. We are wondering: Why is it hard? Why is it shiny? Is it living or nonliving?*

Record and post what we figured out and what we are wondering on or near our Notice and Wonder Chart: G **Examples include:**

- *The corn in the water hasn't changed on day 1.*
- *The dry harvest corn is made out of little kernels that are very hard and shiny and stuck onto a cob on the inside.*
- *We wondered why the harvest corn is hard and shiny.*
- *We wondered if the harvest corn is alive or not.*
- *We also want to know if our wet harvest corn is going to change or stay the same.*

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7. (5 min) Before dismissing students, ask students to brainstorm what our next steps should be in our investigations. H

Suggested Prompts:

➔ What should make sure to do in our next science class?

will make reference to ideas that refer to **patterns** as well.

Add these words, as well as the words **cob** and **kernel** to a science word wall as you introduce them. You may want to tape an example cob and kernel next to each word as reference

Differentiation Strategies and Alternate Activities

F For students who may not know that all organisms have external parts, they can infer that the parts of the kernels and cob of the harvest corn look like the parts of "real corn" they eat, so it might be real corn. It's okay if they are not sure at this point if the corn is real or fake. We want students to continue to ask questions, especially about if it is living or nonliving.

Additional Guidance

G Revisit and add to the Notice and Wondering Chart at key lessons when we have a big take a way related to something we figured out (e.g. after analyzing results from an experiment (i.e .lesson 4b - growth is coming from the kernel (seed) not the cob) or dissection

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➔ What do we need to investigate next time we meet for science?

Listen for *student responses* such as:

We think that we should check our corn submerged in the water bin and draw a picture of our wet harvest corn to see if it has changed.

(like of the seed). Don't use this chart in every subsequent lesson though, because students will get tired of it, and will lose purpose for them.

Formative Assessment Opportunities

H Ask students to complete an exit slip (in science notebook) that asks, "Do you think the corn in real or not? Explain your thinking with at least 2 reasons." You can then have students share their responses in the next class/lesson.

Alignment With Standards

Building Toward Target NGSS PE

- **2-LS2-1.** Plan and conduct an investigation to determine if plants need sunlight and water to grow

Building Toward Common Core Standard(s)

ELA standards:

- CCSS.ELA-LITERACY.SL.2.1-Participate in collaborative conversations with diverse partners about *grade 2 topics and texts* with peers and adults in small and larger groups.
- CCSS.ELA-LITERACY.SL.2.3- Ask and answer questions about what a speaker says in order to clarify comprehension, gather additional information, or deepen understanding of a topic or issue.
- CCSS.ELA-LITERACY.W.2.7- Participate in shared research and writing projects (e.g., read a number of books on a single topic to produce a report; record science observations).
- CCSS.ELA-LITERACY.W.2.8- Recall information from experiences or gather information from provided sources to answer a question.

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Lesson 3: What happened to the wet harvest corn?

Teacher Guide

2nd Grade Unit: How has our corn changed?

Previous Lesson....Where we've been In the last lesson, your students conducted an investigation to figure out what the "corn submerged in water" was made of. They found different structures like kernels and cob, and wrote down what they noticed and wondered.

This Lesson.... What we are doing now Students will observe the corn submerged in water closely, paying attention to changes and patterns of change in the cob and kernels. They'll continue to monitor the changes in the corn as they collect more noticings and wonderings.

Lesson Question	Phenomena Days of plant growth	Lesson Performance Expectation(s)	What We Figure Out (CCCs & DCIs), *New Questions* and ***Next Steps***
L3: What happened to the wet harvest corn? (50 min) *Building toward* ⇩ *NGSS PEs:* *2-LS2-1*	 Days 3-5: The wet harvest corn has changed. There are things coming out of the corn.	**Analyze data** *(Noticing)* recording observations and describing patterns *in how the* ***wet harvest corn has changed.*** **Ask questions** *(Wondering)* about *what other patterns of change we might see in the future and/or might have caused these* ***changes.***	Getting the harvest corn wet seems to have caused changes in it. We notice patterns and changes: • Little things are coming out of the corn • The kernels are becoming more plump and large • The corn is surrounded by water and is near the window. *We are wondering:* • *What are the white things? Are they roots?* • *Did the water help it? Will anything happen without water?* • *Is it because it was next to the window? Will this happen in the dark?* • *Why are the pieces of corn getting bigger? Are those kernels seeds? Is this a plant?* ***Next Steps:*** ***1) We want to figure out what the little things coming out of the corn are.*** ***2) We want to see if anything new happens to this harvest corn submerged in the water bin each day.***

Next Lesson....Where we're going As students continue to observe the corn submerged in water, they start to wonder whether the little white things are growing out of the kernels or the cob, and make plans to investigate this (Lesson 4a). If students argue from evidence that they can already tell that the little white things are growing from the kernels, you can motivate a different question "How many things are growing from each kernel?" for Lesson 4a, or you may want to motivate a jump to Lesson4(s).

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Getting Ready: Materials Preparation

Materials For Each Group

- Harvest corn submerged in the water bin - 1 bin for each group

Preparation of Materials (15 min.)

- Post class "Notice and Wonder" chart from previous lesson for reference.
- Create a new "Notice and Wonder" chart for today's lesson.

Materials For Each Student

- Lesson 3 - Student Activity Sheets (1)

Safety

- None

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Getting Ready: Teacher Preparation

Background Knowledge

LS1.A from the FRAMEWORK:
"Plants also have different parts (roots, stems, leaves, flowers, fruits) that help them survive, grow, and produce more plants."

- In first grade, students were introduced to the following concepts:
  - Plants have different parts.
  - Each of these parts serve a different purpose.
- In the previous lesson, students determined that there are different parts to the harvest corn submerged in the water bin.
- Boundary: Do not name the "little white things growing out of the harvest corn" as stems or seedlings. Allow students to leave this open to interpretation.

Alternative Student Conceptions

In first grade, students learned about different plant structures and may have some ideas about the purpose(s) of those structures. In some cases, students may have only a partial understanding of the idea that roots grow from the bottom of the plant to seek out water and nutrients, or that the leaves grow toward the light to collect light to help the plant grow. Students will likely come in with the background knowledge that plants need light and water to grow, but they may not see the relationship between each plant structure and those needs.

Linking Our Understanding to Scientific Terminology

Students may refer to the white things extending into the water as "roots." Refrain from teaching this terminology at this point in the unit, as we want students to come to the idea that these may be roots on their own. If students mention the term, consider allowing them to conduct an informal investigation to help determine if they are roots or not by moving some of them out of the water and observing how they grow back toward the water.

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Learning Plan: What happened to the wet harvest corn? (50 min)

1. (10 min) Begin with a Consensus Building Discussion[A] to help re-orient students in the storyline. Use the following prompts to help students articulate what they figured out in the last lesson.

Suggested Prompts:

- ➔ What did we wonder about last class? (refer to "Notice and Wonder" chart)
- ➔ We had some ideas about how to investigate our questions. What were our ideas?

Listen for *student responses*[B] that refer to what we figured out last time, such as:

We figured out that the "Harvest Corn" has some different parts like kernels and cob. We decided it is alive. We also decided that we want to keep an eye on the "harvest corn submerged in the water bin" to see what happens to it.

Next, ask students to help set the course for today's lesson.

Suggested Prompts:

- ➔ What should we do today to keep track of the "harvest corn submerged in the water bin?"

Listen for *student responses* that refer to what we figured out last time, such as:

We want to observe the "harvest corn submerged in the water bin" closely and sketch what we see. We want to write down more of what we notice and wonder on our class chart.

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2. (10-15 min) Now that students have articulated what they think we should do in this lesson, to

Teacher Supports & Notes

Strategies for this Consensus Building Discussion

A In this Consensus Building Discussion, let the students take the lead. To build capacity and improve students' confidence leading discussions, introduce some talk moves. Guide students to connect to an idea by saying "My ideas is like yours, _____, because..." This encourages active listening and student-to-student dialogue.

Additional Guidance

B Draw students attention to the Notice and Wonder chart you made in Lesson 2. If students struggle to recall what they figured out, revisit the chart and read some key entries aloud that will jog their memories.

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make observations about the wet harvest corn, gather students in small groups around their group's corn bin.

Give students a chance to closely observe the "harvest corn submerged in the water bin[C]." Students should sketch what they see on Student Activity Sheet 3.1. Once they have sketched what they see, students can take a few moments to fill out what they notice and wonder about their sketch. Students should be encouraged to share out their ideas with their group mates before, during, and after filling out Student Activity Sheet 3.1.

If students finish making observations early, remind them that by talking to their group mates they may identify aspects of the corn they missed in their sketch. Encourage students to be detailed in their sketches, and notetaking. Encourage students to label their drawings. the corn.

---

3. (10-15 min) Once students have had sufficient time to sketch, talk to group mates, and write down what they notice and wonder, gather students together in front of a new Notice and Wonder chart for today's lesson. Encourage students to sit with their group members. The teacher may consider sketching a model of the corn and include important labels (Emphasize detailed wording and descriptions, do not name the changes to the corn. Allow students to leave this open to interpretation.) **and details as well as noticings and wonderings to share with the students.**

Engage students in a whole class Building Understandings Discussion.[D] Use the prompts below to engage students in the discussion. Students can share ideas that they discussed, sketched, or wrote down on Student Activity Sheet 3.1 while the teacher captures ideas and questions on the Notice and Wonder chart. ***Students should glue (or staple) Student Activity Sheet 3.1 into their science notebooks.***

Suggested Prompts:

➔ What did you notice about the wet harvest corn?

Additional Guidance

C Today's writing will begin with the teacher showing the class the corn. The teacher will not say anything about the corn changing. The students will free write in their journal about anything they want and notice about the corn. Students in this grade need to be able to free write based off of a picture or real object.

If your students benefit from additional structure in activities like this, lay out some steps for students to follow in their groups. For instance:

1. Observe the corn silently and independently for 30 seconds.
2. Each student shares what they noticed with no cross-talk in the group.
3. Everyone sketches what they see.
4. Each student shares their sketch to the group, and group members add details as they see what other students added.

Strategies for this Building Understandings Discussion

D As students mention changes in the corn, name these as **patterns**. If students mention terms such as "root," or "kernel," or "seed," name these as **structures** of the corn. Be sure to ask why they named

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➔ What did you wonder about what you saw?

Listen for *student responses* such as:

We notice that the wet corn seems to be changing (patterns). The kernels (structure) are getting soft and plump. We want to know why that's happening. We also see some little things growing out of the corn. We're wondering what those are? Are they roots, E *or are they something else (structure and function)? The corn is kept in water near the window in the same place everyday (patterns). Does the water have something to do with it? What if we moved this away from the window? What if we took some of the white things out of the water?*

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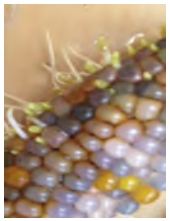
4. (10 min) Before closing the lesson, ask a student to take a picture of the corn in its current state. Label the sketch or picture with the number of days that have passed with the corn submerged in the water (e.g. "Day 6"). Ask students,



Suggested Prompts:

➔ Why would we want to take a picture of our harvest corn?

Listen for *student responses* such as:

If we take a picture of the corn we will be able to remember exactly what it looked like before. This way if it changes we can compare it to what it looked like before.

Then, engage students in sharing ideas about how they want to continue in the next lesson F G**.**

Suggested Prompts:

➔ What should we make sure to do in our next science class?

➔ What do we need to investigate next time we meet for science?

Listen for *student responses* such as:

different parts with those terms, and how they know what they are based on their observations. See if other students agree by asking for a thumbs-up vote. If the class is divided, take note of that as something we need to investigate further.

Additional Guidance

E In previous implementations, students have wondered whether the white structures were roots, but wanted to continue to observe them before making a decision. To do this, they set some of the white things slightly above the water without touching the water. After a few days, students noticed that the white things grew toward the water! From this evidence students can conclude that yes, these white structures are roots.

Formative Assessment Opportunities

F Ask students to complete the sentence starter, "In the next lesson, I think we should _____." Students can capture these in science notebooks or they can be submitted in the form of an exit slip.

Additional Guidance

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We want to keep watching the corn to see if it keeps changing.

G It is recommended that students start keeping track of these activity sheets in a notebook. You may want to have students glue or staple these activity sheets into the notebook at the end of this lesson at this time if they don't have a place to keep all the activity sheets in order in one place.

Alignment With Standards

Building Toward Target NGSS PE

- **2-LS2-1.** Plan and conduct an investigation to determine if plants need sunlight and water to grow

Building Toward Common Core Standard(s)

ELA standards:

- CCSS.ELA-LITERACY.SL.2.1-Participate in collaborative conversations with diverse partners about *grade 2 topics and texts* with peers and adults in small and larger groups.
- CCSS.ELA-LITERACY.SL.2.3- Ask and answer questions about what a speaker says in order to clarify comprehension, gather additional information, or deepen understanding of a topic or issue.
- CCSS.ELA-LITERACY.W.2.7- Participate in shared research and writing projects (e.g., read a number of books on a single topic to produce a report; record science observations).
- CCSS.ELA-LITERACY.W.2.8- Recall information from experiences or gather information from provided sources to answer a question.

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Lesson 4(a): Now what happened to the wet harvest corn?

Teacher Guide

2nd Grade Unit: Why Is Our Corn Changing?

Previous Lesson....Where we've been In the last lesson, your students noticed that little white things are coming out of the corn. They are wondering what the little things are and whether they will change even more, so they decided to leave the corn in the dish and keeping watching it to figure that out.

This Lesson.... What we are doing now Students will need to figure out that the little things look like they are getting longer and bigger, and that its hard to tell whether they are growing from the cob or the kernels. This will motivate the 1st experiment you will guide the class to want to set up at the end of this lesson.

Lesson Question	Phenomena *Days of plant growth*	Lesson Performance Expectation(s)	What We Figure Out (CCCs & DCIs), *New Questions* and Next Steps
L4(a): Now what happened to the wet harvest corn? (60 min) *Building toward* ↓ *NGSS PEs:* *2-LS2-1*	 Day 6: More stuff is coming out and the stuff is longer and some kernels have fallen off.	**Analyze data** *(Noticing)* recording observations and describing patterns *in how the wet harvest corn has changed.* **Ask questions** *(Wondering)* about *what other patterns of change we might see in the future and/or might have caused these changes.* **Design & conduct an investigation** with peers (and teacher guidance), to determine, *which structure are these things coming out of, the kernels or the cob?*	We notice patterns as the wet harvest corn changes: • More stuff is growing out of the corn. • White (and other colored - some green) things look like they are getting longer/bigger. • We notice that the water level is going down. • Some kernels look like they are being pushed off the cob or the cob is falling apart. We argue from evidence that: • We know from 1st grade that "**plants...have different parts that help them...grow**" (LS1.A) so we are thinking that these green and white things are growing since they seem to be getting longer. • If water level is going down, the water must be going somewhere (matter flows). We think maybe the water is going into the corn. We do not all agree on which part of this thing stuff is growing from. Some think the parts are growing from the kernels, and others think they are growing from inside the cob. *Now we are wondering.* • *Is the water going up into the plant? Or is it disappearing?* • *Are the little things growing from the corn or the cob?* ***We want to design an investigation to figure out whether these little things are growing from the kernel(s) or the cob. We know from our dissection of the dry harvest corn that there is a cob on the inside and kernels are stuck to it.***  So we plant the kernels and the cobs separately (or put these in water) to see which, if either, will grow. This is Experiment #1. Since we need to wait a few days before we can see what happens in this experiment, we make a record of this investigation plan (our noticing, our question, our procedure, our prediction) and we move on to planning how to investigate our other question(s) for now. ***Next steps: We will look at the results of this experiment in L4(b). We also want to see what happens with the wet corn next time, so we add more water and measure the amount of water we add every time.***

Next Lesson....Where we're going It will take some time to decide if the little things are coming from the kernels or cob, so in the meantime the students will want to continue observing the growth and asking new questions.

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Getting Ready: Materials Preparation

Materials For The Class

- Dry ears of corn (2)
- Empty trays/containers to break apart the ears of corn
- Tools for breaking the kernels off the cob (pliers/firm objects to pry kernels off)
- Pots with soil in which to place kernels and cob (2). Soil is recommended here so that moldiness doesn't emerge too soon. (a phenomena we want to wait until lesson 8(a))
- Use clear plastic cups as the vessel for corn plantings

Preparation of Materials (15 min.)

- Post "Notice and Wonder" chart from previous lesson.
- Prepare additional trays
- Create an Investigation Plan Outline on chart paper to fill in (step 4b) titled "Investigation Plan Experiment #2 - Cob or Kernel"

Materials For Each Student

- Lesson 4(a) - Student Activity Sheets (1)

Safety

- When breaking the kernels off the cob, tell students all kernels and any tools used must stay in the tray.
- Demonstrate how to safely pry the kernels off the cob or provide work gloves to protect student's hands

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Getting Ready: Teacher Preparation

Background Knowledge

LS1.B from the FRAMEWORK:
"Plants and animals grow and change."

We have already decided that the corn is "real", even though we don't know if it's a live plant. Today, we decide to conduct an investigation of the plant's parts that will help us decide some of the following ideas:

- A plant becomes physically larger over time, with especially fast growth when it is young.
- It starts to look different over time, having more clearly defined parts.

Alternative Student Conceptions

Students should all know that the dry harvest corn is made out of a cob with kernels attached from lesson 2. In this lesson, students design an experiment to test if the things they see coming out of the wet harvest corn are coming from the kernels or the cob. However, some students may think they come out of both parts. Maybe they start inside the cob and go out through the kernels. If this idea comes up, validate the idea, and then talk it through with the students. If we plant the kernels and cob separately, and nothing grows out of either part, then maybe both the kernel and cob are needed to make the little things come out, so let's see what happens!

If students argue that they already can tell (from their observations) that the white things are coming out of the kernals (because they are already falling off the cob), you can hold a consensus building discussion on this, and push to ask "how can we test to see whether the cob alone might be the cause of this?" Or, you can skip this lesson4a and the first half of lesson 4b, and jump to the end of lesson 4b, motivating the next investigation (lesson 4c) which explores whether something might be inside the kernel that is causing it to grow.

Linking Our Understanding to Scientific Terminology

- No new terminology

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Learning Plan: Now what happened to the wet harvest corn? (60 min)

1. (5 min) Begin with a Consensus Building Discussion[A] to help re-orient students in the storyline. Use the following prompts to help students articulate what they figured out in the last lesson.

Suggested Prompts:

- What did we wonder about last class? (refer to "Notice and Wonder" chart)
- We had some ideas about how to investigate our questions. What were our ideas?
- We also decided to dissect the harvest corn a couple of days ago. What was the dry harvest corn made out of?

Listen for *student responses*[B] that refer to what we figured out last time, such as:

We noticed little white things coming out of the corn, and some of us thought they were roots. We wondered whether water and light were important, and why these little things seem to be getting bigger. We wanted to keep watching the corn to see if anything new or different happens, especially with the white things. When we dissected the dry harvest corn, we found out that it wasn't plastic. It was made out of a corn cob with many kernels stuck to it, like the sweet corn we eat.

---

2. (10 min) Now that students have remembered that we just need to check up on our corn, gather students around the Notice and Wonder Chart and the harvest corn submerged in the water for a Sharing Initial Ideas Discussion.

Suggested Prompts:

- What do you notice about the white things?
- What do you notice about the wet harvest corn?

Teacher Supports & Notes

Strategies for this Consensus Building Discussion

A The goal of this discussion is to put students in the driver's seat. Use the prompts to help students recall and restate what we as a class figured out in the last lesson and in Lesson 2 when they dissected the dry harvest corn. Having the students recall that the corn is made up of a cob with many kernels should motivate what we are going to need to do next, in this lesson.

Additional Guidance

B To kick off this discussion, try asking a volunteer to read aloud from the Notice and Wonder charts from Lessons 2 and 3. This will provide a clear reminder. Then, ask other students to restate what we decided we would need to do.

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➔ What do you wonder about the wet harvest corn?
➔ What do you notice or wonder about the water?

Listen for *student responses* such as:

The white things are longer, and there are more of them! It also looks like some kernels are being pushed off the cob or falling apart.

And the water level is going down too. We don't know where the water is going, but we think it might be going up into the corn. We don't know where the white things are coming from either.

Remind students that scientists keep track of their observations so that they can make comparisons later. Ask students to draw a picture[C] of what the corn looks like today in their science notebooks or 4a.1 - Student Activity Sheet so we can look back to compare later.

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3. (10 min) Now, facilitate a Building Understandings Discussion[D] to guide students to articulate what they think we should do to investigate next. Use the prompts below to stimulate ideas and discussion:

Suggested Prompts:

➔ What are the places that the little white things could be coming from?
➔ Do you think the white things are coming from the cob or the kernels? Why?
➔ What do you think we could/should do to help us decide whether the white things are coming from the corn or the kernels?
➔ Should we do anything else to keep track of what happens to the "harvest corn submerged in the water bin"?

Listen for *student responses* that identify the next steps of designing an experiment, such as

The white things are growing from somewhere. They could be coming out of the cob or the kernels! We can't tell which part they are coming from by just looking at them. We are really curious about

Differentiation Strategies and Alternate Activities

C Alternatively, ask students - "What are do scientists do to keep track of their observations?"

Strategies for this Building Understandings Discussion

D Use Talk Moves here to help students go public with their ideas and work with the ideas of others. For example, "Does anyone agree or disagree with Tyrone's idea that the little things are coming from the cob because it looks like the long things are coming from between the kernels, which could mean they are actually coming from the cob underneath?... Why do you agree/disagree?"

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figuring it out. Maybe if we tried growing a cob and kernels in different trays or pots, we would be able to see where the white things were coming from. Maybe we should add water too, since the water is disappearing, and we can keep track of how much we're adding just like we're using our pictures to show the corn growing.

Suggested Prompts: E

- ➔ Can you think of a time when you tried something twice, "just in case"?
- ➔ Do you think we should plant multiple ears of corn/kernels in our experiment? Why or why not?
- ➔ How could planting two separate ears/ multiple kernels help our experiment?

Listen for *student responses* that get at the idea that it is "safer" to do something twice to make sure something doesn't go wrong.

Some examples of doing something twice are baking an extra batch of cookies because one might look bad, tying a double knot in our shoes so our laces don't come undone, adding an extra bit of glue to make sure something sticks together. Just like in these situations, using an extra ear and extra kernels will help make sure that we still have results if something goes wrong with one of the ears/kernels.

4a. (15 min) Ask students to help shell the two ears of corn (remove the kernels from the cob). Students should use the empty trays and tools to safely pry the kernels off the cob. While some students are shelling the corn, other students should prepare containers with soil and measured amounts of water. Then, students should plant the two shelled full cobs in separate containers. The same two cobs will be observed for the whole class. Each small group of students can plant several kernels, but make sure to plant them in separate containers. F

After completing this planting direct students to complete page 2 of student activity sheets 4a.1. Circulate and assist students as they fill in each portion of the sheet, allowing for students to use pictures and words/sentences according to their individual needs.

Differentiation Strategies and Alternate Activities

E This part of the discussion is getting at the characteristic of experiments of performing multiple trials in an experiment. Some students may not be able to think of situations where we do something multiple times "just to be safe." If this seems to be happening, you may want to casually perform such an action in the classroom, like using two pieces of tape to attach a small poster to the wall or double-knotting a shoelace.

Supporting Students in Analyzing and Interpreting Data and Arguing from Evidence

F It's important that students only plant one kernel per container because when they analyze their results from this experiment they will observe that each kernel sprouts a new plant, not that a group of kernels sprout a plant. So students should argue from evidence that the original corn in water actually has multiple plants coming from it, not just one plant and that each kernel has the potential to grow a new plant, which makes them seeds.

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4b. (15 min) Once students have completed the sheet, gather students together to engage in a shared writing experience. Invite students to bring their Student Activity Sheet 4a.1 to the carpet so that they can reference it when it is their turn to share.

Present students with the blank outline of the Investigation Plan, and use the following prompts to help students arrive at the answers that have been filled in on the image below[G]:

Notice	**We noticed**: *Little white things coming out of the corn.*
Wonder	**We wondered**: *Are the white things coming out of the cob or the kernel?*
Investigate	**We decided to investigate this by:** *1. fill two pots with dirt.* *2. Put the corn cob in one pot.* *3. Put a kernel in one pot* *4. Add water to both pots.*
Predict	**We predicted that:** *White things will come out of the cob*

Suggested Prompts:

- ➔ What did we notice was happening with the corn that made us want to design this investigation?
- ➔ What were we wondering when we noticed the little white things?
- ➔ What steps did we decide we will take in this investigation?

Writing Extension

G In this lesson, we introduce the Investigation Plan Outline, which can later be extended into a more formal informational text through Lesson 4a.we.

As you fill out the chart, be sure that students articulate each row and come to consensus through discussion before you complete any of the writing in the chart. Support students in coming to consensus by referring back to previous Notice and Wonder charts and Student Activity Sheets to remind them of the evidence they collected that led them to this point.

Once the chart is filled out, post it clearly in the room so that students can refer back to it later. With multiple experiments running at once, it is important that students can refer back to this anchor chart as a reminder of what they decided to investigate.

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➔ What do you predict will be the answer to our wonder question?

Listen for *student responses* that mimic what is written in the diagram above, such as: .

We noticed that little white things were growing out of the corn.
We wondered whether those white things were growing out of the corn cob or the corn kernels.
We decided to plant some kernels and a chunk of cob separately in two different pots. We will water both the same amount so it is a fair test. We will watch them both to see which ones grow white things!
Some of us predict that the white things are growing out of the kernel, some of us think the cob.

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5. (5 min) Ask students to summarize what our next steps should be in our investigations. H

Suggested Prompts:

➔ Now that we've got our kernel and cob experiment planted, what else should we check on in our next science class?

➔ Today we decided to add the same amount of water to each pot in our new experiment and keep track of how much we add so it's a "fair test." Should we be doing that with our original harvest corn?

Listen for *student responses*[8] such as:

It will take time for our kernel and cob experiment to turn out. If the soil dries out, we should add equal amounts of water to all containers. In the meantime, we should keep checking in on our original harvest corn in water, and start measuring the amount of water we add.

Formative Assessment Opportunities

H Ask students, "Today we figured out how to investigate something new with our harvest corn. What did we decide to investigate? Why do we want to investigate that?" Students can respond verbally or in writing based on class needs.

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Alignment With Standards

Building Toward Target NGSS PE

- **2-LS2-1.** Plan and conduct an investigation to determine if plants need sunlight and water to grow

Building Toward Common Core Standard(s)

ELA standards:

- CCSS.ELA-LITERACY.SL.2.1-Participate in collaborative conversations with diverse partners about grade 2 topics and texts with peers and adults in small and larger groups.
- CCSS.ELA-LITERACY.SL.2.3- Ask and answer questions about what a speaker says in order to clarify comprehension, gather additional information, or deepen understanding of a topic or issue.
- CCSS.ELA-LITERACY.W.2.7- Participate in shared research and writing projects (e.g., read a number of books on a single topic to produce a report; record science observations).
- CCSS.ELA-LITERACY.W.2.8- Recall information from experiences or gather information from provided sources to answer a question.

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Lesson 5: How much did the wet harvest corn change?

Teacher Guide

2nd Grade Unit: How has our corn changed?

Previous Lesson....Where we've been In the last lesson, your students decided to start an experiment to see if the little things coming out of the corn are from the kernels or the cob.

This Lesson.... What we are doing now While your students are waiting for the experiment with the kernels and the cob to grow, they decide to check back on the original harvest corn submerged in water. Encourage students to think about, "how do we really know if something is getting longer or not?"

Lesson Question	Phenomena *Days of plant growth*	Lesson Performance Expectation(s)	What We Figure Out (CCCs & DCIs), *New Questions* and Next Steps
L5: How much did the wet harvest corn change? (40 min) *Building toward* ⇩ *NGSS PEs:* *2-LS2-1*	 Days 7-9: The green and white things are growing longer.	**Analyze data** *(Noticing)* recording observations and describing patterns *in how the wet harvest corn has changed.* **Ask questions** *(Wondering)* about *what other patterns of change we might see in the future and/or might have caused these changes.*	We notice patterns as the wet harvest corn **changes**: • The white and green parts look like they are getting longer. • The water went down, so we added more water. We wanted to say argue that is evidence that the harvest corn was growing, but then realized that we didn't have evidence for growth, because it is hard to know for sure if it is growing bigger unless we have a record of how big it was the day before. If we did have those measurements, then we could tell it got bigger by a comparing the two measurements. *Now we are wondering:* • *Are the parts really getting bigger? How much bigger?* • *If its parts are getting bigger, does that mean its living?* **Next steps: In order to keep track of this we decide we should start measuring each of these structure coming out of the harvest corn with a ruler (to the nearest half centimeters) and keep track of this in our notebooks. We want to keep track of the water we are adding too, since maybe that is related to what we see the harvest corn doing.**

Next Lesson....Where we're going Next, students will focus on the direction of the green and white parts. Why are the green parts all going up and the white parts all going down? Continue measuring these parts when you check in on the wet harvest corn in future lessons.

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Getting Ready: Materials Preparation

Materials For Each Group

- Original wet harvest corn submerged in water (1)

Preparation of Materials (15 min.)

- Prepare blank "Notice and Wonder" chart

Materials For Each Student

- Science notebook or Lesson 5 Student Activity Sheets (1)
- Ruler with cm and half cm. Markings (1)
- Writing utensil (1)

Safety

- None

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Getting Ready: Teacher Preparation

Background Knowledge

LS2.A from the FRAMEWORK:
"Plants depend on air, water, minerals (in the soil), and light to grow."

- The water level in the wet harvest corn is going down
- Students should recognize this. This is the first time we make a noticing about that water level and decide we should fill it back up.

LS1.B from the FRAMEWORK:
"Plants and animals grow and change."

- A plant becomes physically larger over time, with especially fast growth when it is young.
- It starts to look different over time, having more clearly defined parts.

Alternative Student Conceptions

Some students may question if the wet harvest corn is still alive. At this point the green and white shoots should be prominent and the growth should look more plant like.

Today's writing can focus on the following question. Do you think the harvest corn is alive? Write this question on a dry erase board with a YES and No column. Each student will answer this question and the teacher will record their response with tally marks. Students will then write this question down in their notebook and respond in writing. Students will then come together to discuss their responses together.

Students don't need to come to consensus yet on whether this is alive or is a plant. They will do that in lesson 7.

Linking Our Understanding to Scientific Terminology

- none

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Learning Plan: How Much Did the Wet Harvest Corn Change? (40 min)

1. (5 min) Begin with a Consensus Building Discussion[A] to help re-orient students in the story line. Use the following prompts to help students articulate what they figured out in the last lesson.

Suggested Prompts:

- ➔ In the beginning, what did we decide to keep doing with our wet harvest corn?
- ➔ What were we interested in comparing?

Listen for *student responses*[B] that refer to what we figured out last time, such as:

We decided that we should keep checking in on our wet harvest corn to see how it changed. We were going to compare to see how it looks as days go by.

Suggested Prompts:

- ➔ What should we do today in order to keep track of how our corn has changed?

Listen for *student responses*[B] that refer to what we should do this time, such as:

We are still interested in seeing how the original corn has changed. We want to do another notice and wonder chart on our wet harvest corn to see if it's different from the last time we checked it.

---

2. (10 min) Next, move into a Sharing Initial Ideas discussion. Gather students in small groups

Teacher Supports & Notes

Strategies for this Consensus Building Discussion

A Have students pair and share with their science partner, their responses to these suggested prompts and then share out with the rest of the class.

The goal of this discussion is to put students in the driver's seat. Use the prompts to help students recall and restate what we as a class figured out in the last lesson. Their ideas should motivate what we are going to need to do next, in this lesson.

Additional Guidance

B If students struggle to recall that we originally decided as a class to make note of how the corn changed every day, prompt them to consider what phenomena they examined or what activities they engaged in. This might be difficult since we set up an experiment in the last lesson, so refer to the harvest corn submerged in water and

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around their wet harvest corn. Give students a chance to closely observe the wet harvest corn. Create a new "Notice and Wonder" Chart as a class.

Suggested Prompts:

- ➔ What does the harvest corn look like now?
- ➔ How has the harvest corn changed from when we looked at it last?

Listen for *student responses* such as:

We notice patterns like the green and white parts look like they are getting longer. The green parts really look like pieces of grass. We think it is definitely alive and a plant. The water went down. We wonder if we should add more water to it, because the water level is going down.

Write all Notice and Wonderings up on the class chart.

---

3. (5 min) When all students have shared, move into a Building Understandings Discussion. Press on this noticing, "The green and white parts look like they are getting longer."

Suggested Prompts:

- ➔ Many of you noticed that the green and white parts are getting longer, but how do you really know that?
- ➔ If we were to check again tomorrow, could we actually tell by looking at it to see if it got longer?
- ➔ How could we keep track of how long those parts are getting? C

Listen for *student responses* such as:

We just looked at the green and white parts and they look longer than last time, but I guess if we were to look tomorrow we might have a hard time deciding if they were longer or not. It's kind of hard to know for sure if they are getting longer unless we have a record of how long they were the day before. We could measure them with a ruler to keep track of how long the green and white

previous Notice and Wonder charts if they need more guidance.

Strategies for this Building Understandings Discussion

C If students are stuck finding a way to keep track of how those parts are getting longer ask them to think about when they go to the doctors office. How does the doctor know how long you are getting? Does she just take your word for it that you seem taller? No, she measures you each time so there is a record of how tall you are actually getting, or if you aren't growing for some reason. Maybe we could do that with our

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parts are and we should write it down every time so we can look back at how big it was.

---

4. (15 min) Have students measure the length of the white parts and green parts in cm and record their answers in the Student Activity Sheets. Then have students draw what their plant looks like today and compare their notes to the last time they drew the wet harvest corn in lesson 3 D.

Remind students that scientists keep track of their observations so that they can make comparisons later. Ask students to draw a picture of what the corn looks like today in their science notebooks so we can look back to compare later.

If students finish making observations early, remind them that by talking to their group mates they may identify aspects of the corn they missed in their sketch. Encourage students to be detailed in their sketches and notetaking.

Have students add more water to the wet harvest corn containers.

---

5. (5 min) After students have finished their drawings, revisit the question, "What have we figured out so far?" Use the following prompts to guide this Consensus Building Discussion.

Suggested Prompts:

- ➔ What did we find out after our Noticing and Wonder Chart?
- ➔ What should we keep doing to our Wet Harvest Corn?

Listen for *student responses* such as:

We figured out that we really should measure the green and white parts with a ruler to keep track of how long they are getting. This way we have a record to rely on instead if just using our eyes.

plants - measure it to keep track if it's actually growing or not.

Formative Assessment Opportunities

D Student Activity Sheet 5.1 could be collected to give students feedback about their measurements and drawings about their harvest corn. You could also ask students to write down their comparisons and contrasts with the notes about the last time they drew their harvest corn for another opportunity for feedback.

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We should probably keep measuring it and keep checking in on it. We also realized that we should probably keep adding water to the plant. The water levels are going down, so maybe the plant needs water to keep growing. We are wondering how important the water is to the plant.

Alignment With Standards

Building Toward Target NGSS PE

- **2-LS2-1.** Plan and conduct an investigation to determine if plants need sunlight and water to grow

Building Toward Common Core Standard(s)

ELA standards:

- CCSS.ELA-LITERACY.SL.2.1-Participate in collaborative conversations with diverse partners about grade 2 topics and texts with peers and adults in small and larger groups.
- CCSS.ELA-LITERACY.SL.2.3- Ask and answer questions about what a speaker says in order to clarify comprehension, gather additional information, or deepen understanding of a topic or issue.
- CCSS.ELA-LITERACY.W.2.7- Participate in shared research and writing projects (e.g., read a number of books on a single topic to produce a report; record science observations).
- CCSS.ELA-LITERACY.W.2.8- Recall information from experiences or gather information from provided sources to answer a question.

Math standards:

- CCSS.MATH.CONTENT.2.MD.A.1-Measure the length of an object by selecting and using appropriate tools such as rulers, yardsticks, meter sticks, and measuring tapes.

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Lesson 6(a): Why are the different parts growing in different directions?

Teacher Guide

2nd Grade Unit: Why Is Our Corn Changing?

Previous Lesson....Where we've been In the last lesson students drew attention to patterns in the way the corn is growing and changing. They decided that the best way to keep track of these patterns is to measure the growth of the white and green stuff growing out of the corn with a centimeter ruler.

This Lesson.... What we are doing now When presented with a new phenomena, the video clip of plants growing toward light, students will wonder whether light has anything to do with the growth they've noticed on the corn. They'll design an investigation to test whether or not light is needed.

Lesson Question	Phenomena *Days of plant growth*	Lesson Performance Expectation(s)	What We Figure Out (CCCs & DCIs), *New Questions* and Next Steps
L6(a): Why are the different parts growing in different directions? (75 min) *Building toward* ↓ *NGSS PEs:* *2-LS2-1*	 Day 10: Green sprouts are now widening at the top. A timelapse video of tomatoes plants show the green parts of them bending toward the light and growing in that direction over time:	**Analyze data** *(Noticing)* **and use mathematical thinking** to record observations, measure lengths,, describe (and graph) patterns in *how the much the wet harvest corn grew and what else has changed.* **Ask questions** *(Wondering)* about *what other patterns of change we might see in the future and/or might have caused these changes.* **Design & conduct an investigation** with peers (and teacher guidance), to determine, *if our harvest corn needs light to keep growing?*	We notice patterns as in how the wet harvest corn changes : • We have measurements that help us prove the green things are getting longer and wider at the top each day (which we use calculate the difference between these measurements as evidence of how much it grew). • We have similar calculations, that provide evidence that the white things are growing longer too. • We have similar calculations, that provide evidence that the water level is going down too. • The green parts kind of look like leaves. They are bending toward the light. • The white parts kind of look like roots. They are bending toward the water. We argue from evidence that this thing is growing (its structures are getting longer) and it's starting to look more like a plant. *Now we are wondering:* • *So are the green things related to something about light? Are they leaves or not?* • *So are the white things related to something about water? Are they roots or not?* We decided to see if something we know is a plant bends its leaves toward the light as it grows. So we looked at video recording of a tomato plant growing over many days (a time-lapse - fast forward video). We noticed similar patterns in how the tomato plant in the video grows and changes. Its leaves are growing toward the light. We argue from evidence that because the our thing is growing toward the light, just like the tomato plant is: • It might be a plant; these green things might be its leaves. • Maybe the leaves are for helping the plant get light. • Maybe all plants need light to grow.  *Now we are wondering: Does this thing need light in order to keep growing?* **We decide to break off a chunk of the cob and put it in the dark and keep one out in the light. We don't want to put all the cob in the dark because then we couldn't tell if the dark makes a difference without anything to compare it with. This is Experiment #2.** Since we need to wait a few days before we can see what happens in this experiment, we make a record of this investigation plan (our noticing, our question, our procedure, our prediction) and we move on to planning how to investigate our other question(s) for now. ***Next steps: We will look at the results of this experiment in L6(b). We also want to see what happens with the wet corn next time, so we add more water and measure the amount of water we add every time.***

Next Lesson....Where we're going In the next lesson, students will pause to reflect on their noticings and wonderings. In doing so, they'll figure out that the corn must be living because it is growing and changing.

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Getting Ready: Materials Preparation

Materials For Each Group

- Harvest corn submerged in the water bin
- 1 container to use for planting a chunk we break off of the original harvest corn
- Centimeter Ruler
- Use clear plastic cups as the vessel for corn plantings

Preparation of Materials (15 min.)

- Create a new Notice and Wonder chart for today's lesson.
- Pull up and test the video of the shoots growing toward the light: https://www.youtube.com/watch?v=_qaEdV6oGgU
- Ensure that students can locate their Student Activity Sheet 5.1
- Create a new Investigation Plan Outline and title it "Does the Corn Need Light to Grow?"

Materials For Each Student

- Lesson 6(a) - Sudent Activity Sheets (1)
- Lesson 5 Student Activity Sheets (previously filled out by each student)

Safety

- Remind students that cob and kernels stay in the tray

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Getting Ready: Teacher Preparation

Background Knowledge

LS1.A from the FRAMEWORK:
"All organisms have external parts."

In first grade, students were introduced to the following concepts which will be referenced in today's lesson.

- Plants have different parts (roots, stems, leaves, flowers, fruits) that help them survive and grow.
- Plants and/or animals respond to information they receive from the environment.

Alternative Student Conceptions

Students may not yet agree on whether or not the corn is alive. If students do not come to consensus on the idea that the corn is alive, you should continue on to Lesson 7*. However, if students agree that the corn is alive because it is growing and changing, you can skip lesson 7 and move on to Lesson 4b.

*Do not skip Lesson 6(a).

Linking Our Understanding to Scientific Terminology

- Leaves (knowledge from first grade)
- Stems (knowledge from first grade)
- Roots (knowledge from first grade)

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Learning Plan: Why are the different parts growing in different directions? (75 min)

1. (5 min) Begin with a Consensus Building Discussion A to help re-orient students in the storyline. Use the following prompt to help students articulate what they figured out in the last lesson, referring to the Notice and Wonder chart from the previous class.

Suggested Prompts:

➔ In the last lesson we made a decision about the harvest corn. What did we decide to do?

Listen for *student responses* that refer to what we figured out last time, such as:

We saw that the leaves that are coming out of the corn were getting bigger, so we decided we wanted to keep track of how much bigger they are getting. We decided we would do that by measuring the leaves and keeping track of the measurements in centimeters.

---

2. (15 min) Invite students to move to their groups to do their daily observation of the harvest corn submerged in the water bin. Hand out materials, including Student Activity Sheet 6(a).1, to each group so that they can record the height and width of the green parts of the corn. Students may name these "leaves" based on prior experience in first grade. Ask students to sketch the corn on page 1 of the Student Activity Sheet, this time adding labels according to what they think they see.

Then, gather students together around the Notice and Wonder chart for the day. Use the following prompts to get students talking B:

Suggested Prompts:

➔ What did you notice when you measured your corn today?

Teacher Supports & Notes

Strategies for this Consensus Building Discussion

A To engage students in the work that needs to be done in this lesson, solicit their ideas about what was figured out and decided in the last lesson. If students struggle to recall what was decided, draw attention to the Notice and Wonder chart from the last class.

Alternate Activity

B To get more students involved in discussions, you could reorganize students into partnerships or groups to share their observations. Then, ask each group to report out to the whole group what their group discussed, capturing ideas on the

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➔ Do you notice any patterns in the way the corn is growing and changing? What are they?
➔ When you sketched your corn today, what details did you add? What labels did you add? Why?
➔ Do any of these parts remind you of parts you've seen on plants?

Listen for *student responses*[C] such as:

We noticed that the green things are growing taller. The pattern we see is that every day the leaves get taller. When we sketched, we added tall stems shooting out of the corn and the little white things coming out of the bottom. We drew white stuff on the corn and the green at the top of the shoots. We labeled the green things leaves because we think that's what they are. Then we labeled the little white things roots because they are growing toward the water and that's what they look like.[D]

---

3. (5 min) Now you'll introduce a new phenomena to students. Say, "today I want to show you a video clip that I found that made me think about what is happening with the corn. While you watch, I want you to be thinking about what you notice. Be ready to share your ideas with your group members.

Show the video of the tomato plant sprouting and growing toward the light.[D] **You may need to show the video two or three times to give students ample time to process what they see. Once you have shown the video, ask students to turn and talk to the people near them to share what they noticed about the plants in the video.**

Next, use the following prompts to engage students in an Initial Ideas Discussion to find out what they noticed about the plants in the video.

Suggested Prompts:
➔ What did you notice about the plants in the video?
➔ Why do you think the plants moved the way they did?

Notice and Wonder chart.

Strategies for this Initial Ideas Discussion

C Use clarifying language such as, "Why do you think they are roots?" or "What makes you think these are leaves?" to help draw out students' thinking.

If students do not reference the leaves and the roots in their sketches or mention them when they share ideas, ask questions such as "What about these things? Did you draw these? What do you think they are?"

Alternative activity

D This lesson focuses on using noticings about the direction the green parts of the plant are growing to motivate an investigation about whether plants need light to grow.

But, some students may suggest that we should also do another experiment, to see if the roots are growing toward water. In the past some students have suggested ideas such as moving the kernels out of the water a bit, and then seeing if the roots still grow toward the water. This additional investigation should be pursued if students

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➔ How is what we saw in the video similar and different to the corn submerged in the water bin?

Listen for *student responses* that mimic the next step in the storyline, such as

The tomato plants moved! It looked like they were bent away from the window at first, and later they bent toward the window. We think they were moving toward the light coming in from the window. This is similar to the corn in our classroom because our corn has green stuff growing out of it that looks like the green leaves on the plant in the video.

---

4. (5 min) Following the discussion of the video of the tomato plant, bring students back together for a Consensus Building Discussion. Use the following prompts to help students map out the next steps of the lesson.

Suggested Prompts:

➔ Some of you said that the tomato plants in the video followed the light from the window. Does light have anything to do with our corn submerged in the water bin? How do you know?

Listen for *student responses* such as:

The green parts of the corn are growing up out of the bin and toward the light. We keep the bin by the window, so we think light has something to do with it, but we're not sure what.

Suggested Prompts[F]:

➔ What could we do to figure out if light is important to the stuff growing out of the corn?

➔ How will we figure out if light has anything to do with the green stuff growing out of the corn?

Listen for *student responses* such as:

We decide to break off a chunk of the cob and put it in the dark and keep one out in the light. We don't want to put all of the cob in the dark because then we couldn't tell if the dark makes a

raise this idea.

Alternative activity

[E] If you have students who are typically reluctant to share their initial ideas, pause the video a few times and give students opportunities to write down what they notice while you play the video. Then, when students are sharing they will be able to read what they wrote down, rather than simply recalling what they noticed.

Strategies for this Consensus Building Discussion

[F] One of the goals of grade two is to understand the scientific concept of a "fair test." Students need to understand that only one variable can be changed and there must be a "control" to which it can be compared. Therefore, when students are designing the experiment, it is important to use questioning to help students realize that we must place one plant in the light and one in the dark so we have something for a comparison. If we only place a plant in the dark, we may be considering too many variables in our experiment. The plant in the light is our control. The amount of

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difference without anything to compare it with. This is Experiment #2. We decide that we also need to measure the growth of both our plant in the light and our plant in the dark, just like we have been measuring our other experiments.

5a. (15 min) Place students in groups and hand out materials, including Student Activity Sheet 6(a).1, the corn submerged in the water bin, and two additional containers with a measured amount of water to plant the part students break off. Circulate and assist students as they break off 2 pieces of the corn submerged in the water bin and place each one into a new container. Then, each group should place one new corn plant by the window in the light, and the other container in a designated dark place, like a cabinet. **Note that it will take 9+ days for corn plants to sprout**

When students have completed the steps, ask them to fill out page 2 of their student activity sheets.

5b. (15 min) Once students have completed the sheet, gather students together to engage in a shared writing experience. Invite students to bring their Student Activity Sheet 5a.1 and 6a.1 to the carpet so that they can reference them when it is their turn to share. Present students with the blank outline of the Investigation Plan, and use the following prompts to help students arrive at the answers that have been filled in on the image below[G]:

Notice	**We noticed** our green parts of our plant were leaning towards the sunlight
Wonder	**We wondered** if plants need sunlight and water to grow.
Investigate	**We decided to investigate this by:**

water, the amount of soil, and the size of the pots must be the same in both the dark and the light.

Writing Extension

G In this lesson, we revisit the Investigation Plan Outline, which can later be extended into a more formal informational text through Lesson 6a.we.

As you fill out the chart, be sure that students articulate each row and come to consensus through discussion before you complete any of the writing in the chart. Support students in coming to consensus by referring back to previous Notice and Wonder charts and Student Activity Sheets to remind them of the evidence they collected that led them to this point.

Once the chart is filled out, post it clearly in the room so that students can refer back to it later. Now, students are keeping track of the original harvest corn submerged in the water bin, the kernel or cob experiment (#2), and today's investigation. Post the Investigation Plan Outlines clearly next to one another in the room so students can

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	1. Separate the two containers. 2. Place one container in the sunlight with dirt and the other in the closet with dirt. 3. Water the same amount to each plant everyday.
Predict	**We predicted that:** the plant in the sunlight will grow more than the plant in the closet.

Suggested Prompts:

- ➔ What did we notice that was happening with the corn that led us to this investigation?
- ➔ What were we wondering when we noticed the little white things?
- ➔ What steps did we decide we will take in this investigation?
- ➔ What do you predict will be the answer to our wonder question?

Listen for *student responses* that mimic what is written in the diagram above, such as: .

We noticed that our plant was leaning toward the sunlight and the water was going down in our containers.

We wondered whether plants need sunlight to grow.

We decided to put one container in the sunlight, and another container in a dark cabinet.

Some of us predict that the plant in the sunlight will grow more than the plant in the closet.

---

6. (5 min) Before dismissing students H, ask students to restate what our next steps should be in our investigations.

Suggested Prompts:

keep these experiments straight.

Formative Assessment Opportunities

H Ask students to describe the experiments they have started, and to tell why they are doing them. You can use an exit slip and pose questions such as, "What did we decide to do with the corn today?" "What are we trying to figure out with this experiment?" Students are making adequate progress when they respond that they are trying to figure out if plants need light to grow. Watch for students who confuse this experiment with the others. Be sure to remind them of the video they watched to help them understand that we are trying to learn whether or not plants need sunlight to

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➔ What are the things we agreed we need to track as we move forward?

Listen for *student responses* such as:

We need to watch our corn submerged in the water bin and measure how tall it's getting.
We want to put a piece of the corn in the dark to see if light is important to the corn growing and changing.
We also have our experiment from Lesson 4 where we split up the corn into cob and kernels and we want to keep watching to see if anything happens with that.

grow.

Alignment With Standards

Building Toward Target NGSS PE

- **2-LS2-1.** Plan and conduct an investigation to determine if plants need sunlight and water to grow

Building Toward Common Core Standard(s)

ELA standards

CCSS.ELA-LITERACY.W.2.1
- Write opinion pieces in which they introduce the topic or book they are writing about, state an opinion, supply reasons that support the opinion, use linking words (e.g., because, and, also) to connect opinion and reasons, and provide a concluding statement or section.

CCSS.ELA-LITERACY.W.2.2
- Write informative/explanatory texts in which they introduce a topic, use facts and definitions to develop points, and provide a concluding statement or section.

CCSS.ELA-LITERACY.W.2.7
- Participate in shared research and writing projects (e.g., read a number of books on a single topic to produce a report; record science observations).

CCSS.ELA-LITERACY.W.2.8
- Recall information from experiences or gather information from provided sources to answer a question.

Math standards

CCSS.MATH.CONTENT.2.MD.A.1
- Measure the length of an object by selecting and using appropriate tools such as rulers, yardsticks, meter sticks,

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	and measuring tapes. CCSS.MATH.CONTENT.2.MD.A.3 ● Estimate lengths using units of inches, feet, centimeters, and meters.

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Lesson 7: What have we noticed and what are we wondering so far?

Teacher Guide

2nd Grade Unit: Why Is Our Corn Changing?

Previous Lesson....Where we've been In the last lesson students noticed that the green part of the plants seem to be growing up, toward the light. This made them wonder if plants need light, so they planted a chunk of cob in the dark and another in the light to see which would grow better.

This Lesson.... What we are doing now You will help students take stock of all the interesting noticings that have observed so far, the claims they can make based on the evidence they have so far to conclude that the harvest corn is a living plant, and the questions that have yet to answer. (If the class has done Notice and Wonder most days and decided that the corn is a living plant, this lesson can be omitted).

Lesson Question	Phenomena *Days of plant growth*	Lesson Performance Expectation(s)	What We Figure Out (CCCs & DCIs), *New Questions* and **Next Steps**
L7: What have we noticed and what are we wondering so far? (50 min) *Building toward* *NGSS PEs:* *2-LS2-1*	 Day 11: Roots are more intricate. Leaves are getting darker greener, bigger, opening up/uncurling. Very little of the seed is left. Kernels are falling apart. The roots are still white.	**Analyze data** *(Noticing)* **and use mathematical thinking** to record observations, measure lengths, and, describe (and graph) patterns in how the much the wet harvest corn grew and what else has changed. **Ask questions** *(Wondering)* about *what other patterns of change we might see in the future and/or might have caused these changes.* **Engage in argument from evidence** to answer the question whether this thing ***is a living plant(s)?, by*** *analyzing why these different forms of evidence: patterns of growth, similar structures, and predictable stages of development are relevant to the question.*	***We decide to check up on our noticings and wonderings.*** (If the class has done Notice and Wonder every day and decided that the corn is a living plant, this lesson can be omitted. If the class has not had a chance to do a notice and wonder day in a while this is a time to take stock of what the students have figured out so far, and what we still have questions about.)  *Example observations and questions:* • *We keep having to add water to the harvest corn every day. Maybe the cob is using up the water?* • *The white things look like roots and they are growing toward the water. So are* • *Do the different parts do different things? We think maybe...* • *Will the roots keep growing? How tall will the green things get?* • *Is it one plant, or many plants?* We argue from evidence to answer an earlier question: *Is this thing a plant?* • We from our measurements that a lot of growth and change is taking place. Since "plants...grow and change" (LS1.B addressed in K-LS1-1), we think this is evidence that this may be one or many plants. • It has green parts as well as the shape of parts (structures) that plants have like roots, stems, and leaves, and it doesn't move around, which we know from personal experience. We already know that "Plants...have different parts (roots, stems, leaves...)" (LS1.A, addressed in 1-LS1-1). And with it growing, this makes us really certain this is a plant. • We also see that we can break off different parts of the cob and grow them separately. And the different corn plants all look different from when they were younger, which means that they must grow in a similar way. ("Plants...have predictable characteristics at different stages of development." (LS1.B)) So now we think this may actually be many plants growing at once. ***Next steps: We also want to see what happens with the wet corn next time, so we add more water and measure the amount of water we add every time.***

Next Lesson....Where we're going In the next lesson, students will return their focus to Experiment #1, and it will be clear that the kernels sprouted while the cob did not.

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Getting Ready: Materials Preparation

Materials For Each Group

- Student Activity Sheet 7.1

Preparation of Materials (15 min.)

- Gather old Notice and Wonder charts and identify unanswered questions.
- Create a new Notice and Wonder chart for additional noticings and wonderings.

Materials For Each Student

- None

Safety

- None

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Getting Ready: Teacher Preparation

Background Knowledge

LS1.B from the FRAMEWORK:
"Plants and animals grow and change.."

This principle, established in kindergarten, should be remembered by students during this lesson.

- A plant becomes physically larger over time.
- It starts to look different over time.

LS1.A from the FRAMEWORK:
"All organisms have external parts...Plants also have different parts...that help them survive, grow, and produce more plants."
This principle was established in 1st grade.

LS1.C from the FRAMEWORK:
"Plants need water...to live and grow."

- From these statements, we can define a living thing as something that can grow and has different parts that help it survive. A living thing also needs water.

Alternative Student Conceptions

This is the lesson where some students' conception that the corn is not alive is finally addressed fully. Students should realize in this lesson that corn is alive and is a plant.

Linking Our Understanding to Scientific Terminology

- Living thing

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Learning Plan: Why are the different parts growing in different directions? (50 min)

1. (20 min) Begin with a Consensus Building Discussion to help re-orient students in the storyline. Use the following prompt to help students articulate what they figured out in the last lesson, referring to the Notice and Wonder chart from the previous class.

Suggested Prompts:

- ➔ In the last lesson we started a new experiment. What was that experiment?
- ➔ Why did we start that experiment?

Listen for *student responses* that refer to what we figured out last time, such as:

We saw that the green parts of the plant (leaves) were growing toward the light, so we wondered if plants need light. We placed some corn in water in the light, and another chunk of the corn cob in some water in the dark.

From this point, work backward through old Notice and Wonder charts. Ask students which wonderings they have answered. Circle those. Possible *student responses* include:

We wondered what the corn was made of, and saw that it has different parts, a cob and kernels. We wondered what the white and green things were. We decided that they are roots and leaves.

Then ask students which wonderings they have started experiments to answer. Box them and put a checkmark on a post-it note near them A **. Possible *student responses include:***

We wondered whether the little things are growing from the kernels or the cob, so we planted some kernels separately from the cob to see which would grow. We also started the experiment to see if the corn needed light in the last lesson.

Teacher Supports & Notes

Additional guidance

A Returning to the charts and identifying what has been accomplished can be very gratifying for students. You may want to dwell on this each time you do it for a moment, celebrating that accomplishment.

This is another way to build a sense of a shared scientific community that has a shared mission plan as well as a shared journey that we are traveling on together.

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Finally, ask students which wonderings they still haven't answered. Point these out to them and highlight some of the most interesting ones. Possible *student responses* include:

> *Why do we have to keep adding water to the corn? Do the roots have something to do with water, since they're growing that way? How big will the roots and leaves get? Is the corn alive? Is it a plant?*

---

2. (10 min) Remind students that sometimes we need more information to answer certain questions, but you think we might know enough to answer some of our questions. Put students into pairs B **and have them answer each of the two main questions listed on Student Activity Sheet 7.1, "Is the corn alive?" and "Is the corn a plant?" Remind students to provide evidence from our class and their own experiences to support their ideas.**

---

3. (15 min) Have another Consensus Building Discussion. Throughout the activity, refer students to the sheets they just completed. First, resolve the question of whether or not the corn is alive C**.**

Suggested Prompts:

- ➔ What do we think makes something alive? Why
- ➔ What are some examples of things that are alive and not alive?
- ➔ What did we say a living thing was in kindergarten?
- ➔ Have we seen the corn do anything that living things do?

Listen for *student responses* that indicate that the corn is alive, such as:

Differentiation Strategies and Alternate Activities

B Some students have probably expressed strong opinions on this subject before this point. Try to pair students with peers with whom they disagree but will listen to, so that they can come up with an answer together that they are comfortable sharing with the class. For example, it may make sense to pair two quiet students together so that they have the opportunity to speak. You may also wish to utilize other participation strategies like calling on students at random.

Formative Assessment Opportunities

C If desired, take a thumbs-up poll before discussing these questions to determine how many students think the corn is alive, and how many think it is a plant.

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*We know that **"all living things need water** (LS1.C)," and we have to keep adding water to the corn, so maybe it needs that water and is alive. We also think that living things grow and change, which our measurements show the corn is doing. Therefore the corn is alive.*

Then discuss whether or not the corn is a plant.

Suggested Prompts:

- ➔ What makes a plant a plant?
- ➔ What do plants have in common?
- ➔ What are some examples of plants?
- ➔ What do we know about plants from first grade and kindergarten?
- ➔ Have we seen the corn do anything that plants do?
- ➔ If the corn is a plant, what can we say about other plants?

Listen for *student responses* that indicate that the corn is a plant, such as:

*We know that **"plants…grow and change** (LS1.B)," which our corn is definitely doing. We've also noticed that the corn has different parts that seem like the parts of a plant. We know that **"plants…have different parts (roots, stems, leaves)"** (LS1.A), and we have seen those parts in our corn. The corn must be a real, living plant! That means that corn will do many things that other types of plants do.*

---

4. (5 min) Before dismissing students, ask students what our next steps should be.

Suggested Prompts:

- ➔ What of our remaining questions do we most want to answer?

Additional Guidance

D In Lesson 6a, the class came to consensus that the structures growing toward the water are roots.

Some classes of students at this point (or before) have suggested conducting a new investigation to test this claim. For example, putting the corn on a platform slightly above the water to see if the roots will grow into or toward the water. If students suggest this, consider using a variation of this question in lesson 8a, to see "do plants roots grow toward water and what do they do with it?" this can motivate testing one condition without water and monitoring water levels over the course of the investigation, so that students can ultimately conclude that the plant is taking water, which it needs in order to grow, from the surroundings through its roots.

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Listen for *student responses* such as:

We need to keep measuring our corn to see how tall it can get and how long the roots get. We'll want to check up on our other experiments. We planted the kernels and cob separately awhile ago, so that would be a good experiment to look at again next.

Alignment With Standards

Building Toward Target NGSS PE

- **2-LS2-1.** Plan and conduct an investigation to determine if plants need sunlight and water to grow

Building Toward Common Core Standard(s)

ELA standards
CCSS.ELA-LITERACY.SL.2.1
Participate in collaborative conversations with diverse partners about grade 2 topics and texts with peers and adults in small and larger groups.
CCSS.ELA-LITERACY.SL.2.1.A
Follow agreed-upon rules for discussions (e.g., gaining the floor in respectful ways, listening to others with care, speaking one at a time about the topics and texts under discussion).
CCSS.ELA-LITERACY.SL.2.1.B
Build on others' talk in conversations by linking their comments to the remarks of others.
CCSS.ELA-LITERACY.SL.2.1.C
Ask for clarification and further explanation as needed about the topics and texts under discussion.

Math standards (if applicable)

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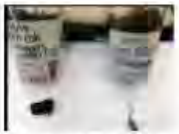
Lesson 4(b): What did we figure out from planting the kernels and the cob?

Teacher Guide

2nd Grade Unit: Why Is Our Corn Changing?

Previous Lesson....Where we've been In lesson L4(a) your students set up an experiment where they planted kernels in one container and the cob in the other to figure out what part of the corn are the plant sprouts coming from.

This Lesson.... What we are doing now It's time to check on the results from Experiment 1 in lesson L4(a). You'll guide them to analyze the two different containers, one with the kernels planted and the other with part of the cob planted through the cross-cutting concept lens of structure and function.

Lesson Question	Phenomena *Days of plant growth*	Lesson Performance Expectation(s)	What We Figure Out (CCCs & DCIs), *New Questions* and Next Steps
L4(b): What did we figure out by planting the kernels and the cob? (70 min)  *Building toward* ↓ *NGSS PEs: 2-LS2-1*	 Day 12: When we check back at our Experiment #1 the corn cob alone didn't sprout, but the kernels did (5-6 days after planting)	**Analyze data** *(Noticing)* **and use mathematical thinking** to record observations, measure lengths, and, describe (and graph) patterns in how the much the wet harvest corn grew and what else has changed. **Engage in argument from evidence** by co-constructing a oral & written argument supported by evidence that a different plant is growing from (a particular structure) each kernel, not from the cob.	We notice patterns in how the wet harvest corn changes : • The corn cob didn't sprout, but the kernels did. • Each kernel is sprouting its own plant structures. We argue from evidence: • The kernel is the part (structure) that the plant grows from, not the cob. • Other plants we know grow from seeds (**"Plants also have different parts...that help them...produce more plants" (LS1.A).**, so since the kernel is growing a new plant, then it must be a seed, not the cob. • The purpose (function) of each kernel/seed - is to help the corn produce another plant. The seed of the plant is a key structure that helps the plant produce another plant • There are many kernels on the cob, and each of the kernels are sprouting. Therefore the corn has many plants growing from it, because it has many seeds on it. Each kernel can grow into a separate corn plant. *We have a new question that came from these results: What's inside that seed that helps the plant grow?* **Next steps: We want to look inside seed) to see if there is anything inside of it that is responsible for this growth we are seeing coming from it. We think we can look at a seed of any plant to figure this out, because seeds are the structures that produce new plants.**

Next Lesson....Where we're going Now that your students have decided that the kernels are seeds that the corn plant starts growing from, they will investigate what is it about the seeds that makes plants grow?

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Getting Ready: Materials Preparation

Materials For Each Group

- Our experiment containers from Experiment 1 - corn kernels vs. corn cob planted (1)

Preparation of Materials (15 min.)

- Blank paper available for students to use for more drawing space
- Containers of coloring utensils for drawing experiment results
- Post the Investigation Plan from Lesson 4(a) that you completed together as a class.
- Prepare a blank Scientific Explanation Outline on chart paper.

Materials For Each Student

- Lesson 4(b) - Student Activity Sheets or Lab Notebook

Safety

- None

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Getting Ready: Teacher Preparation

Background Knowledge

LS1.B: "Plants and animals have predictable characteristics at different stages of development."

- Seeds do not look like plants.

In this lesson help students notice that:

- Baby plants are still attached to their seeds.

In later lessons help students notice that

- as a plant gets bigger, the seed may fall away.

LS1.A: "Plants also have different parts (roots, stems, leaves, flowers, fruits) that help them survive, grow, and produce more plants."

- Seeds help produce more plants.

Alternative Student Conceptions

Students may come into this lesson thinking that the harvest corn is plastic. At the end of the dissection, students should be convinced that it's not hollow or made out of plastic. They still might be wondering if it is alive or not, even if they are convinced the corn is "real."

Help students consider the idea that the kernel might be a seed.

Linking Our Understanding to Scientific Terminology

- Seed

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Learning Plan: What did we figure out from planting the kernels and the cob? (70 min)

1. (10 min) Begin with a Consensus Building Discussion A to help re-orient students to what we are investigating in Experiment 1. Use the following prompts to help students articulate why we set up Experiment 1.

Suggested Prompts:

- ➔ What did we plant in each of the containers?
- ➔ What was the big question that made us want to set up this experiment?

Listen for *student responses* B that refer to what we figured out last time, such as:

We planted the cob in one container and the kernels in the other containers. We noticed that the green things were coming out of the corn, but we couldn't tell where they were coming from. When we got to dissect the dry harvest corn, we knew it was made up of a cob on the inside and kernels on the outside. The white/green things could be coming from either part, so we decided to plant them separately and see which one grew - cob or the kernels!

---

2. (5 min) Next, shift to a Building Understandings Discussion. Use the following prompts to guide students to articulate what they think they should focus on in today's lesson .

Suggested Prompts:

- ➔ What evidence do we need to collect from each of the containers?

Teacher Supports & Notes

Strategies for this Consensus Building Discussion

A It's important for students to not only recall that they did plant the corn kernels and cob in separate containers, but they should also talk about *why* they did that experiment. It is because we couldn't tell if the little things, or sprouts, were coming out of the kernels or the cob. So, if we plant them separately and sprouts only come from one part, then we know which part they were coming from on our original wet harvest corn.

Strategies for this Initial Ideas Discussion

B You may want your students to pull out their Student Activity Sheets 4a.1 to remember their predictions and help articulate the reason we decided to set up the experiment.

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- ➔ What should we be looking for in the container where we planted the cob and in the container where we planted the kernels? C
- ➔ If we saw sprouts coming from the cob container, what would that tell us?
- ➔ If we saw sprouts coming from the kernel container, what would that tell us?
- ➔ What were your original predictions?
- ➔ Should we measure anything?

Listen for *student responses* that mimic the next step in the story line, such as

We should be looking to see if we see any sprouts coming from the cob or the kernel containers. If sprouts are coming from the cob, that would tell us that something about the cob helps make a plant. If the spouts are coming from the kernels, that would tell us that something about the kernels helps make a plant. If we see any sprouts maybe we should measure them in centimeters like we are measuring them in our main containers of harvest corn. If both cob and kernels have sprouts, then we would want to know which ones are longer.

---

3. (10 min) Gather students around the cob and kernels experimental containers and allow students time to explore the results and make observations in small groups.

Suggested Prompts:

- ➔ What do you observe about the container with the planted cob?
- ➔ What do you observe about the container with the planted kernels?
- ➔ Did each of the kernels sprout a plant? Or did only a group of kernels sprout one plant?

Listen for *student responses* such as:

We saw that the container with the planted cob didn't have anything growing out of it, but the

Alternate Activity

C This would be a great question to ask the students and have them share and pair with their partner what they think the answer is to this question.

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container with the planted kernels had sprouts coming up!

Remind students that scientists keep track of their observations so that they can make comparisons later. Ask students to capture their results by drawing or writing in words what the see in each container using the Student Activity Sheet 4b.1. Hand out rulers so that students can measure their plants in centimeters and record the values for each container.

---

4. (10 min) Once students have recorded their data, bring them back together as a whole group, having team members sit close to one another for a Building Understandings Discussion[D]. In this discussion, use the following prompts to help students analyze and use their data as evidence to make sense of what they observed in both containers.

Suggested Prompts:

- ➔ Did each group have the same results? What was that pattern?
- ➔ Let's think about our results through our structure and function glasses or lens. If the kernels did sprout something, what do you think the function of the kernels could be? Why do you think that?
- ➔ If the cob didn't sprout anything, what do you think the function of the cob could be? Why do you think that?

Listen for *student responses* such as:

Every group only had sprouts coming from the kernels, not the corn. We think that the function of the kernels could be to make baby plants. We think this because some of us dug up the plant sprouts and saw that the stems were coming right out of the kernels. It was like the baby plant shot out of the kernel since the baby plants. Could the kernels be seeds? Is the main function of a seed to make baby plants? Some of us think that the kernels could be seeds, but we are not all totally sure yet.

Since the cob didn't have any baby plants coming out of it then, it's function probably isn't to make baby plants. Maybe it's function is to give the kernels something to hold on to.

Strategies for this Building Understandings Discussion

D The crosscutting concepts can be used explicitly with students as a lens to help them think in a certain way about a question. As students share, draw attention first to the CCC **patterns**. What was the **pattern** in our data?

Then ask students to use the CC of **structure** and **function**. If the **structure** of the kernels gave rise to the sprouts, what could be their **function**? If the **structure** of the cob gave rise to the sprouts, what could be its **function**?

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Suggested Prompts:

- ➔ Did a baby plant come out of every kernel you planted?
- ➔ Let's think back to our original harvest corn in water. So do you think the sprouts that we see make the cob, just one plant or lots of plants?

Listen for *student responses* such as:

Yes, a baby plant grew out of almost every kernel we planted. So this makes us think that the our harvest corn in water actually isn't just one plant! Since there are a lot of kernels and each kernel has the potential to start a baby plant, our corn has many plants growing from it! The whole corn cob isn't one seed, it has many seeds.

---

5. (15 min) Refer students back to the Investigation Plan from Lesson 4(a). Read through each piece, asking students to clarify what we decided to do. Use the following prompts to engage students in this process:

Suggested Prompts:

- ➔ What were we trying to figure out in our investigation plan? What was our question?
- ➔ What steps did we agree to take to answer our question?
- ➔ Did you predict correctly?

Listen for *student responses* such as:

We wondered whether those white things were growing out of the corn cob or the corn kernels. We decided to plant some kernels and a chunk of cob separately in two different pots. We will water both the same amount so it is a fair test. We will watch them both to see which ones grow white things!

The people who predicted that the white things were growing out of the kernels were correct!

Introduce students to the idea that after an investigation, scientists reflect on what they learned by

Writing Extension

E In this lesson, we introduce the Scientific Explanation writing, which can later be extended into a more formal informational writing through Lesson 4b.we.

As you fill out the chart, be sure that students articulate each row and come to consensus through discussion before you complete any of the writing in the chart. Support students in coming to consensus by encouraging them to go public with their conclusions, being sure to ask them to support their ideas with evidence that you collected as a class. Refer back to any class Notice and Wonder charts or other materials that may assist students with supporting their ideas with evidence.

Post this chart in the room next to the Investigation Plan Outline for Lesson 4(a). This will help students to see that

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making a claim or drawing a conclusion that is supported with evidence that they collected. Explain that scientists work together to discuss the claims to be sure they are in agreement before they decide to publish their findings. We call this "consensus."

Use the following prompts to complete a shared writing piece that matches the image below[E]:

Claim / Conclusion	**We now know that:** *The white things grow out of the kernels, not the cob.*
Evidence	**We know this because:** *after 6 days we saw white things on the kernels in the pot with only a kernel in it. We saw no white things on the cob in the pot with only the cob in it.*

Suggested Prompts:

- ➔ What claim or conclusion can we make that helps answer our question from our investigation plan?
- ➔ What evidence did we collect that supports our claim and proves it is true?

Listen for *student responses* that mimic what is written in the diagram above, such as: .

We can claim that these things are growing out of the kernels.
Because the only thing we changed between the two pots was whether we planted a cob or a kernel, we can conclude that there is something special about the kernel must cause the white things to grow from it, instead of the cob.

Suggested Prompts:

they have concluded this investigation, while others may still be going on.

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➔ What do you think might be special about these kernels that allows things to grow out of them?

Maybe there is something inside the kernels that is helping it grow.
Maybe the kernels are seeds.
Maybe these are baby plants coming out of the kernels/seeds

---

6. (10 min) Revisit the question, "What have we figured out so far?" and write down on a class chart or what the class agrees on. Use the following prompts to guide this Consensus Building Discussion. F

Suggested Prompts:

➔ What did we find out after we looked at our results?
➔ If the kernels are seeds, then what is their function?
➔ What do plants produce seeds for? What is their function?
➔ Do seeds of other plants grow things out of them?
➔ What questions do we now have?

Listen for *student responses* such as:

We figured out that the sprouts are coming from the kernels, not the cob. This probably means that the kernels are seed.

If the kernels are seeds then function of the kernels is to make baby plants and the function of the cob is for something else (maybe for providing the plant structure or for holding up the kernels).

*Plants have different parts on them that do different things, and one of those things is to make more plants like the kernels of our corn (*Plants also have different parts...that help them...produce more

Formative Assessment Opportunities

F As an exit slip, have students write down the answer to "What could the function of the kernels be and why? What could the function of the cob be and why?"

You may find that some students will be able to respond in writing with evidence and support to back up their answer, while other students may need to work with the teacher, so the teacher can write down their responses and they can then copy into their notebook.

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plants" LS1.A).

We think that our wet harvest corn in water actually has lots of plants growing from it because there are lots of kernels and each kernel can make it's own plant. The whole corn cob isn't one plant.

We are wondering:

Could the kernels be seeds?
Is the main function of a seed to make baby plants?
Is there something inside a seed that makes a baby plant start to grow?

---

7. (5 min) Before dismissing students, ask them to brainstorm what our next steps should be in our investigations.

Suggested Prompts:

- ➔ What should make sure to do in our next science class?
- ➔ What should we investigate next time we meet for science?

Listen for *student responses* such as:

We really want to know more about how a kernel could make a baby plant. Is there something inside of it that makes a baby plant? We think that a kernel might be like other seeds we've seen. We think that we should dissect some kernels and seeds to see what's inside of them.

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Alignment With Standards

Building Toward Target NGSS PE

- **2-LS2-1.** Plan and conduct an investigation to determine if plants need sunlight and water to grow

Building Toward Common Core Standard(s)

ELA standards:

- CCSS.ELA-LITERACY.SL.2.1-Participate in collaborative conversations with diverse partners about grade 2 topics and texts with peers and adults in small and larger groups.
- CCSS.ELA-LITERACY.SL.2.3- Ask and answer questions about what a speaker says in order to clarify comprehension, gather additional information, or deepen understanding of a topic or issue.
- CCSS.ELA-LITERACY.W.2.7- Participate in shared research and writing projects (e.g., read a number of books on a single topic to produce a report; record science observations).
- CCSS.ELA-LITERACY.W.2.8- Recall information from experiences or gather information from provided sources to answer a question.

Math standards:

- CCSS.MATH.CONTENT.2.MD.A.1-Measure the length of an object by selecting and using appropriate tools such as rulers, yardsticks, meter sticks, and measuring tapes.

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Lesson 4(c): Does the seed have something in it that's alive?

Teacher Guide

2nd Grade Unit: Why Is Our Corn Changing?

Previous Lesson....Where we've been Last time, students reflected on experiment #1 and found that the plant was definitely growing from the kernel, not the cob. They figured out that the kernel must be a seed, which led them to wonder whether or not that seed contains something that is alive.

This Lesson....What we are doing now: Students will watch a time-lapse video of a bean sprouting, which will lead them to investigating what is inside a bean through dissection. Through their investigation they will figure out that all wet seeds have tiny plant structures (roots) in them that will help the plant grow.

Lesson Question	Phenomena	Lesson Performance Expectation(s)	What We Figure Out: (CCCs & DCIs), *New Questions* and Next Steps
L4c: Does the seed have something inside of it that is helping the plant grow? (75 min) *Building toward* ↓ *NGSS PEs* *2-LS2-1*	Day 13: A timelapse video shows structures (similar to those we saw on harvest corn) sprouting out of a bean in wet dirt. Dissection of a wet seed sitting in water for a day reveals different structures inside of it then a dry seed that was not sitting in water. 	**Conduct an investigation** *(Investigate)* dissecting a dry and wet lima bean to *determine the parts (structures) inside the wet lima bean that helps it produce a baby plant.* **Engage in argument from evidence** to answer the question, "Does the seed have something inside of it that is helping the plant grow?" making a claim that the wet seed has some root-like structure growing in it but the dry seed does not.	We were wondering if the seed has something inside of it that is helping the plant grow, we thought we could look at a seed from another plant to figure this out, because seeds are the structures that produce new plants, but wanted to confirm this, so we wanted to see a different plant growing from a seed. From observations made from the time-lapse video, we notice patterns: • Plant structures are sprouting out of a wet bean (seed). Now we think we could dissect a bean seed instead of corn, to see what, if anything, is inside the seed, that is helping the plant grow, since beans are bigger and easier to cut and corn is small and hard to cut. From the dissection we notice patterns: • Most wet seeds have a small root inside them, but dry seeds don't. • There isn't a baby plant inside the seed, but there is a structure there (similar to the roots we've seen that plants have that looks like what sprouted out of our harvest corn and grew). Some of us can't believe what we see and want to check whether this is also in other seeds. From repeated observations we notice: • There is one of these structures in each seed that we look at. We argue that the wet seed has a root like structure growing inside of it that can produce a baby plant, but the dry seed does not. So the function of the seed is to help produce more plants from growing a small root in them. Seeds must get water from its surroundings from this root structure, which allows it to start growing a baby plant inside them because there was no other visible plant structures inside the dry seed. The water must cause the seed (kernel) to start growing this root-like structure. So from this argument we now think that: • **"Plants also have different parts...that help them...produce more plants" (LS1.A)** • **"Organisms [plants] obtain the materials they need to grow...from the environment" (LS2.B)** because the only difference between the dry and wet seed, was that they soaked in water. If students ask for multiple beans to dissection, then: We also argue that we wanted/needed to look in more than one seed, because what we were seeing didn't match what we expected (it was kind of unbelievable). We decided that this gives us an idea of what is a good thing

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Lesson Question	Phenomena	Lesson Performance Expectation	What We Figure Out: (CCCs & DCIs), New Questions and Next Steps
L4c continued			to do in any investigation: when we see something that doesn't match what we expect, it is becomes more believable if we repeat it and get the same result. This is something we decided to keep in mind for future investigations we design. *Next steps: We also want to see what happens with the wet corn next time, so we add more water and measure the amount of water we add every time.*

Next Lesson....Where we're going Students will revisit the harvest corn submerged in the water bin, noticing that the water has become stinky. They will wonder about how the dirty water affects the growth of the corn plants.

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Getting Ready: Materials Preparation

Materials For Each Group

- Sample corn kernels and soaked beans for students to touch to determine if beans are suitable for dissection

Preparation of Materials (15 min.)

- Make copies of Student Activity Sheet 4C.1
- Test and pull up the YouTube video: http://www.youtube.com/watch?v=EKx4ZwoJqXY
- Gather materials for dissection
- 1 bean and 1 corn kernel for comparison under a document camera or iPad camera projected for all students to see (alternate: take a photograph of the two side by side to share with students)
- Notice and Wonder chart from Lesson 2

Materials For Each Student

- Soaked bean (1)
- Tray to dissect bean (1)
- Hand lens
- Student Activity Sheet 4C.1

Safety

- Caution students to be careful with their bean during dissection so as not to crush it
- If students need scissors to cut into the bean, exercise caution
- Make sure students keep seeds away from their mouths

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Getting Ready: Teacher Preparation

Background Knowledge

LS1.A from the FRAMEWORK:
"All organisms have external parts."

In first grade, students were introduced to the following concepts which will be referenced in today's lesson.

- Plants have different parts (roots, stems, leaves, flowers, fruits, seeds) that help them survive, grow, and produce more plants.

Alternative Student Conceptions

Students have confirmed that the corn is real, but they may enter the lesson thinking that the corn is dead, or rotten. By the end of this lesson, students should be able to articulate that the corn kernels are seeds, just like the beans they dissected, and inside seeds are "baby plants" which are alive.

Linking Our Understanding to Scientific Terminology

- Structure
- Seed

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Learning Plan: What is inside a seed that makes it grow? (75 min)

1. (10 min) Begin with a Consensus Building Discussion[A] to help re-orient students in the story line. Use the following prompts to help students articulate what they figured out in the last lesson.

Suggested Prompts:

- ➔ What did we figure out in our last class by looking at Experiment #1?
- ➔ What did our experiment results make us wonder?

Listen for *student responses*[A] that refer to what we figured out last time, such as:

When we looked at Experiment #1, we saw that the kernel sprouted little plants, but nothing happened to the cob.
We figured out that the plants growing out of the harvest corn submerged in water are coming from the kernels, not the cob. We think this might mean that the kernels are seeds.
We are wondering how seeds work, and why they can grow a plant when they seem like they are hard and dead. Are the seeds alive? We want to know what is inside the seed that makes it grow.

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2. (30 min) Present students with the corn kernel and the bean seed side by side, either under a document camera or using an alternate method[B]. Then, ask students:

Suggested Prompts:

- ➔ What do you remember about the corn kernel from our investigation of whether or not the corn was real?[C]
- ➔ Was it easy to see inside the corn kernel?

Teacher Supports & Notes

Strategies for this Consensus Building Discussion

A The goal of this discussion is to put students in the driver's seat. Use the prompts to help students recall and restate what we as a class figured out in the last lesson. Their ideas should motivate what we are going to need to do next, in this lesson.

Additional Guidance

B You may want to take a close-up picture of the corn kernel and the bean side by side, perhaps with a ruler in the photo to show that one is much larger than the other.

Additional Guidance

C Refer to the Notice and Wonderings chart from lesson 2 if students struggle to recall the investigation.

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Listen for *student responses* that mimic the next step in the story line, such as

The corn kernels were really hard. We had to stomp on them to get them to open up!

Tell students that you have an idea about a way you could see what is inside a different type of seed. Show the YouTube video (http://www.youtube.com/watch?v=EKx4ZwoJqXY). As you show the video, pause at the following points and use the following turn and talk prompts with students:

- **0:21:** This image is after the seeds have been watered and sitting in the soil for a few days. What do you notice? What do you wonder?
- **0:48:** A few more days have passed. What has changed?
- **1:12:** Something big is happening. What do you notice? What do you think causes that?
- **2:00:** Many days have passed now. What do you predict will happen next?

Give students a moment to turn and talk about what they saw. Then, play the video again, prompting students to think about how this will help us figure out what is inside the corn kernel that allows it to grow. D

Hand out some soaked beans and corn kernels to groups of students to examine. Prompt students to consider how beans can help us with our investigation.

Next, shift to a Sharing Initial Ideas Discussion E **. Use the following prompts to guide students to articulate what they think they should focus on in today's lesson .**

Suggested Prompts:

- ➔ What do you think we could/should do to help us figure out what is inside a seed that makes it grow? How is the wet seed different than the dry seed?
- ➔ How could using a bean instead of a corn kernel help us know what is inside a seed that makes it grow? How do you know they are the same?

Differentiation Strategyiesand Alternate Activities

D You may want to have another Science Meeting at the Carpet at this point, where you have students discuss what they observed.

Help students identify what **structures** look similar between the bena and the kernel. Connect this d to previous learning by saying that both the corn kernel and bean are consider seeds. Ask students about what they know about seeds and help them to generate more questions about seeds.

Sudents could investigate these further in lesson 9, when they design their own investigations.

Strategies for this Initial Ideas Discussion

E In this discussion, students should lay out the path for the activities they will engage in today. Use the prompts to ensure that students do this heavy lifting to generate ideas.

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Listen for *student responses* that mimic the next step in the story line, such as

We can open up a bean to see what's inside.
We know this will work because the bean plants sprouted just like our corn kernels did, so that must mean they are seeds, too.
The beans are bigger than the corn kernels, and they are softer and easier to take apart.
We think we should take apart a bean and see what's inside to answer our questions about seeds.

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3. (20 min) Once students agree that dissecting the beans is a good next step, hand out dissection materials to each group, along with the Student Activity Sheet. First, ask students to sketch what they predict the inside of the DRY bean will look like. Then, invite students to open the bean by locating the ridge along the edge and pulling the sides apart. Next, invite students to use their hand lenses to observe the inside of the bean closely. Then, have students sketch what the inside of the bean actually looks like. F **Then, hand out the WET bean. Ask students to sketch what they predict the inside of the WET bean will look like. Then, invite students to open the bean by locating the ridge along the edge and pulling the sides apart. Next, invite students to use their hand lenses to observe the inside of the bean closely. Then, have students sketch what the inside of the wet bean actually looks like.** G

With the dissection complete, bring students back together for a Consensus Building Discussion H**.**

Suggested Prompts:

- ➔ What do you observe when you opened up the bean? How was the inside of the DRY bean different from the inside of the WET bean? What made this difference?
- ➔ How was your prediction similar or different to what the inside of the bean actually looked

Additional Guidance

F Students may request the need for more than1 trial. So have many beans soaked so that they may open up more than one bean. Encourage this, as it opens up an opportunity to add this idea into the next discussion: *We argued that we wanted/needed to look in more than 1 seed, because what we were seeing didn't match what we expected (it was unbelievable). We decided that this gives us an idea of what is a good thing to do in any investigation: when we see something that doesn't match what we expect, it is becomes more believable if we repeat it and get the same result. This is something we decided to keep in mind for future investigations we design..*

Differentiation Strategy and Alternate Activities

G You can have students work with groups to create a poster that displays what they discovered.

Strategies for this Consensus Building Discussion

H In order to involve as many students as possible in this discussion, you may want each group member to share out one noticing before the dissection and one

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like?

- ➔ What structures did you observe inside the bean? What do you think their purpose is?
- ➔ How does the seed sprout? What does it need to be able to sprout? Where does it get that from?
- ➔ How does the sprout keep growing?
- ➔ How would the structures you found inside the bean help this thing keep growing into a baby plant?

Listen for *student responses* such as:

We don't see a baby plant inside the seed, we see only some parts of it (the roots)!
We think that when the seed gets water the root can start to grow.
We remember from the video that the seed sprouted and some parts (roots) went down and some parts (stems/leaves) went up.
We think that when the seed gets wet, the roots grow, to get it more water to keep growing before the rest of the baby plant sprouts.

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7. (5 min) Before dismissing students, ask student to brainstorm what our next steps should be in our investigations.

Suggested Prompts:

- ➔ What should make sure to do in our next science class?
- ➔ What do we need to investigate next time we meet for science?

Listen for *student responses* such as:

We think that we should check our corn submerged in the water bin and measure how the leaves have grown. We also should measure the amount of water in the bin, because we think that is what it is getting from the surroundings to help it grow.

noticing after the dissection.

If time is an issue, ask a few volunteers to share with the whole group, and allow the remaining ideas to be shared with an elbow partner.

As students share, draw attention to crosscutting concepts where possible. For example, if students reference the corn having different parts, use the terms **structure** and **function** to restate what students share., to help them connect the structure of what they saw to a root-like structure

- What is the function/purpose of the structure you saw inside the seed?
- How is this related to what we think a plant/seed needs to grow?
- Why didn't the dry seed have this structure?

Formative Assessment Opportunities

I Collect student activity sheet 4C.1. Look for students who carried out the investigation, following all of the steps and recording their observations accurately.

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8. (10 min.) Ask students to complete the two questions on the second page of Student Activity Sheet 4C.1 and submit them as a formative assessment.

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Alignment With Standards

Building Toward Target NGSS PE

- **2-LS2-1.** Plan and conduct an investigation to determine if plants need sunlight and water to grow

Building Toward Common Core Standard(s)

ELA standards:

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- CCSS.ELA-LITERACY.SL.2.3- Ask and answer questions about what a speaker says in order to clarify comprehension, gather additional information, or deepen understanding of a topic or issue.
- CCSS.ELA-LITERACY.W.2.7- Participate in shared research and writing projects (e.g., read a number of books on a single topic to produce a report; record science observations).
- CCSS.ELA-LITERACY.W.2.8- Recall information from experiences or gather information from provided sources to answer a question.

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Lesson 8(a): How did the harvest corn change?

Teacher Guide

2nd Grade Unit: Why Is Our Corn Changing?

Previous Lesson....Where we've been In the last lesson, we figured out that seeds get water from their environment in order to sprout.

This Lesson.... What we are doing now Many classes will notice that the leaves of the harvest corn appear to be bending toward the window near where they are growing. When presented with an additional phenomena, the video clip of plants growing toward light, students will wonder whether light has anything to do with the growth they've noticed on the corn. They'll design an investigation to test whether or not light is needed.

Lesson Question	Phenomena *Days of plant growth*	Lesson Performance Expectation(s)	What We Figure Out (CCCs & DCIs), *New Questions* and **Next Steps**
L8(a): How did the harvest corn change? (55 min) *Building toward* *NGSS PEs:* *2-LS2-1*	 Day 14: The water is getting stinky and gray and cloudy and fruit flies are flying around the plants	**Analyze data** *(Noticing)* **and use mathematical thinking** to record observations, measure lengths, and, describe (and graph) patterns in how the much the wet harvest corn grew and what else has changed. **Ask questions** *(Wondering)* about *what other patterns of change we might see in the future and/or might have caused these changes.* **Design & conduct an investigation** with peers (and teacher guidance), to determine, *where will our harvest corn grow best (in clean vs. dirty water or in dirt vs. no dirt)?*	We notice new patterns in how the wet harvest corn changes • The water that our corn cob is sitting in is getting stinky • The water is cloudy and gray • Fruit flies are flying around the plants We argue that that the dirty water is an example of when **"the places where plants...live often change, sometimes slowly and sometimes rapidly." (LS2.C)** *This stinky water has raised new wonderings:* • *Will those roots keep growing?* • *Will the leaves keep growing?* • *Will it die in this water? Is something wrong?* Some of us think the plant might die if we keep it in the stinky water. We decided something might be wrong in the water, but we aren't sure, so we want to do an experiment/design a solution to see if the cloudy water is affecting its growth. This led us to wonder if other types of water or dirtiness affect the growth of our plants. This leads to a broader question we want to investigate: *Where will our harvest corn grow best?* **We set up four different conditions for our plants (old water, fresh water, soil with water, and no water). We measure their current size/height and take observations to see if there will be a difference in these different environments. This is Experiment #3.** Since we need to wait a few days before we can see what happens in this experiment, we make a record of this investigation plan (our noticing, our question, our procedure, our prediction) and we move on to planning how to investigate our other question(s) for now. ***Next steps: We will look at the results of this experiment in L8(b). We also want to see what happens with the wet corn next time, so we add more water and measure the amount of water we add every time.***

Next Lesson....Where we're going We observe our corn planted in different environments and figure out that plants need water to keep growing, too, not just to start growing. It helps if the water is relatively clean.

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Getting Ready: Materials Preparation

Materials for the Whole Class

- 4 pieces of already-growing corn
- Container with clean water
- Container with the water the corn has been growing in
- Container with soil
- Use clear plastic cups as the vessel for corn plantings

Preparation of Materials (5 min.)

- Verify that there is enough corn growing to break off small chunks for this experiment (without damaging the plant)
- Cutting apart the cobs may require a fairly sharp knife, which you should handle.
- Obtain potting soil and sufficient containers for the investigation.

Materials for Each Student

- Lesson 8a - Student Activity Sheets (1)

Safety

- Remind students that they should let adults handle sharp tools.

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Getting Ready: Teacher Preparation

Background Knowledge

LS1.C from the FRAMEWORK: "Plants need water…to live and grow."

LS2.B from the FRAMEWORK:
"Organisms obtain the materials they need to grow and survive from the environment."

LS2.C from the FRAMEWORK:
"The places where plants…live often change, sometimes slowly and sometimes rapidly…..If they cannot find enough…water…they may die."

In first grade, students were introduced to the following concepts which will be referenced in today's lesson.

- Plants are organisms.
- Examples of external parts are leaves and roots.
- Leaving for later: parts of animals and other organisms.

Alternative Student Conceptions

Linking Our Understanding to Scientific Terminology

- Environment
- Decompose

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Learning Plan: How did the harvest corn change? (55 min)

1. (5 min) Begin with a Consensus Building Discussion[A] to help re-orient students in the storyline. Use the following prompts to help students articulate what they figured out in the last lesson.

Suggested Prompts:

- ➔ In the last class, what did we do and learn?
- ➔ Where does corn get the water it needs to grow?
- ➔ How did we figure that out?

Listen for *student responses* that refer to what we figured out last time, such as:

We looked at wet and dry bean seeds. The wet seeds had little plants in them, while the dry seeds did not. We realized that this means that the plants must need water, which they get from their environment (what's around them).

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2. (10 min) Gather students around the Notice and Wonder Chart and the harvest corn submerged in the water for a Sharing Initial Ideas Discussion. Pass out the Student Activity Sheet, and give students a moment to observe the corn and fill out page 1 of the sheet. Then, use the following prompts to draw their attention to particular aspects of the corn.

Suggested Prompts:

- ➔ What do you notice about the water?
- ➔ What else do you notice about this environment?[B]
- ➔ What parts of the plant are in this water? The leaves or the roots?
- ➔ Is this environment good for the plant's growth?

Teacher Supports & Notes

Strategies for this Consensus Building Discussion

A As students reflect on what they learned in the last lesson, you may need to draw their attention to their Student Activity Sheets to review their sketches of the inside of the bean seed. It may be challenging for students to recall the link between the dry and wet bean seeds and the fact that plants need water to grow. You may need to walk students through the process of the bean seed investigation to help recreate that logic.

Additional guidance

B This will be the first time you have introduced the word **environment.** An initial understanding of this idea would be the surroundings around the plant.

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➔ What might a better environment be for its roots?

Listen for *student responses* such as:

The water is getting smelly and cloudy. There may be fruit flies or other insects flying around the corn.
It looks like the roots are what is in the water, not the leaves.
Gross water doesn't seem like it would be good for the plant. It might be better if the corn was in clean water

Suggested Prompts:

➔ Is it better for the plant's roots to grow in something dirty or something clean?
➔ Is this kind of dirtiness different than something like dirt? Or is is the same?
➔ Do you think it's better for the roots of the plant to be in dirt or not?

Listen for *student responses* such as:

Since plants outside seem to grow in dirt, maybe dirt is better for plant growth.
Maybe dirty water is actually better than clean water.
Maybe clean water is better for plants, because plants are living things. And clean water is better for animals.
Or maybe dirt that you grow plants in is different than this kind of dirty water. It might be better if the corn was in clean water or soil.
But maybe you don't need dirt, because the plant seems to have grown fine so far without it.
We could investigate this by trying to grow a plant in dirty water and one in clean water and see which grows better.
We could investigate this by trying to grow a plant with dirt and without, and see which one grows better.

Strategies for this Building Understandings Discussion

B There will be two investigations that can come out of this discussion. One will be related to the question "Does clean water help plants grow better than dirty"

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3. (10 min) Now, facilitate a Building Understandings Discussion B to guide students to articulate what they think we should investigate next in terms of water and in terms of dirt. Use the prompts below to stimulate ideas and discussion:

Suggested Prompts:

- ➔ How could we investigate what type of environment is best for the corn?
- ➔ What are some different environments we could put the roots of the corn in?
  - ➔ Would the plant grow better with its roots in clean water or dirty? How could we investigate that?
  - ➔ Would the plant grow better with its roots in dirt or not? How could we investigate that?
  - ➔ Do plants even need dirt to grow? How could we investigate that?
- ➔ Which environment do you think the corn will do best in?
- ➔ Which environment do you think will be bad for the corn?

Listen for *student responses* that identify the next steps of designing an experiment, such as

We could put different corn plants in different environments. Some of us think that the best environment for the corn would look more like how it grows outside. That means we would need soil.

We want to see if the corn would do better in clean water, so we should try that too. But since we're not really sure if the clean or dirty water matters, we should keep the dirty water going as well.

We want to see if the corn would do better in dirt or not. So we could also try leaving some corn in lots of dirt and one without,, to check if this kind of dirtiness is the same as the dirt.

4a. (10 min) Place a few kernels of corn or a piece of the cob in each of the four environments: in a container with clean water, a container with dirty water, a container with soil (that will be watered), and in a container of dry soil (that will not be watered). C Once the corn is re-planted

Additional guidance

C This experiment is being set up intentionally so that more than one independent variables is being changed at once. This will lead to results that will be trickier to analyze.

But it will motivate the need to compare only one thing different at a time, to draw conclusions and make claims about what caused different outcomes.

You will use the four containers to draw two different evidence-based arguments from the results in lesson 8b, and use the "too much changing at once" problem from this setup to motivate the importance of trying to change only 1 thing in the students investigations they design in lesson 9.

Try to start with kernels sprouted corn that is the same size to start with in each of the containers.

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in each environment, ask students to fill out page 2 of the Student Activity Sheet. Make sure they record the initial lengths of the corn in each container.. As they sketch and label each environment, be sure they draw clear distinctions between each environment in their labeling. Remind students to make predictions as well on their activity sheets.

4.b. (15 min) Once students have completed the sheet, gather students together to engage in a shared writing experience. Invite students to bring their Student Activity Sheet 8a.1 to the carpet so that they can reference it when it during the discussion. Present students with the blank outline of the Investigation Plan, and use the following prompts to help students arrive at the answers that have been filled in on the image below D:

Notice	**We noticed** that the water in the container was getting dirty and kind of smelly.
Wonder	**We wondered**: if the dirty water is affecting the corns growth. We had two questions: Do plants grow better in clean water? Do plants grow better in dirt?
Investigate	**We decided to investigate this by:** 1. Setting up four containers 2. **The first** was the corn placed in a container of clean water. 3. **The second** was the corn placed in a container of dirty water. 4. **The third** was corn placed with soil and watered daily. 5. **The fourth** was corn placed in an empty container that would not be watered.

Writing Extension

C In this lesson, we revisit the Investigation Plan Outline, which can later be extended into a more formal informational text through Lesson 8a.we.

As you fill out the chart, be sure that students articulate each row and come to consensus through discussion before you complete any of the writing in the chart. Support students in coming to consensus by referring back to previous Notice and Wonder charts and Student Activity Sheets to remind them of the evidence they collected that led them to this point.

Once the chart is filled out, post it clearly in the room so that students can refer back to it later. Now, students are keeping track of the original harvest corn submerged in the water bin, and today's investigation (#3). Post the Investigation Plan Outlines clearly next to one another in the room so students can keep these experiments straight.

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Predict	**We predicted that:** we each had different predictions about where the plant would grow best_____

Suggested Prompts:

- ➔ What did we notice was happening with the corn that made us want to design this investigation?
- ➔ What were we wondering when we noticed the dirty water?
- ➔ What steps did we decide we will take in this investigation?
- ➔ Which of our pots will this help us figure out if plants grow better in clean water?
- ➔ Which of our pots will this help us figure out if plants grow better in dirt?
- ➔ What do you predict will be the answer to our wonder question?

Listen for *student responses* that mimic what is written in the diagram above, such as: .

We noticed that the water in the corn bin was getting dirty and kind of smelly.
We wondered whether the dirty water was affecting the corn. We also wondered what kind of environment is best for the corn to grow in.
We decided to set up four different containers. The first one would be corn with clean water, the second would be corn with the existing dirty water, the third was corn in soil and watered every day, and the fourth was corn in an empty container with no water.
The clean and dirty water containers will help us figure out if plants grow better in clean water
Comparing the containers with dirt to the containers without will help us figure out if plants grow better in dirt.
Some of us predict that the corn growing in clean water will grow the best. Others think the soil will be the best environment for the corn.

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5. (5 min) Ask students to summarize what our next steps should be in our investigations.[7]

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Suggested Prompts:

- ➔ What should make sure to do in our next science class?
- ➔ What do we need to investigate next time we meet for science?

Listen for *student responses* such as:

We want to make sure we keep watching and measuring the corn in all these different environments.

Alignment With Standards

Building Toward Target NGSS PE

- **2-LS2-1.** Plan and conduct an investigation to determine if plants need sunlight and water to grow

Building Toward Common Core Standard(s)

ELA standards
CCSS.ELA-LITERACY.W.2.8
Recall information from experiences or gather information from provided sources to answer a question.
CCSS.ELA-LITERACY.SL.2.1
Participate in collaborative conversations with diverse partners about grade 2 topics and texts with peers and adults in small and larger groups.
CCSS.ELA-LITERACY.SL.2.1.A
Follow agreed-upon rules for discussions (e.g., gaining the floor in respectful ways, listening to others with care, speaking one at a time about the topics and texts under discussion).
CCSS.ELA-LITERACY.SL.2.1.B
Build on others' talk in conversations by linking their comments to the remarks of others.
CCSS.ELA-LITERACY.SL.2.1.C
Ask for clarification and further explanation as needed about the topics and texts under discussion.

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Lesson 8(b): What have we figured out from Experiment #3?

Teacher Guide

2nd Grade Unit: Why Is Our Corn Changing?

Previous Lesson....Where we've been In lesson 8(a), we wondered if the stinky water was affecting plant growth. That led us to wonder more about what conditions plants need to grow, so we set up experiment #3, placing a chunk of our plants in four different containers: one with clean water, one with the stinky water, one with no water, and one in soil.

This Lesson.... What we are doing now Today students will go back to observe experiment 3. They will analyze the results of the experiment by comparing plant growth across the four conditions (clean water, stinky water, no water, soil and water). Students will conclude that the plant growing in soil and water is the healthiest, while the one without water is dying. They will conclude that plants need water to grow!

Lesson Question	Phenomena	Lesson Performance Expectation(s)	What We Figure Out (CCCs & DCIs), *New Questions* and **Next Steps**
L8(b): What did we figure out by putting it in different places?	 Days 15-20: Different amounts of plant growth and change under different conditions. Plant in nothing dies. Plant in soil with water grows the highest and has the least discoloration. The plants in the freshwater grow almost as well as those in soil. And plants in the stinky water grow the least.	**Analyze data** *(Noticing)* **and use mathematical thinking** to record observations, measure lengths, and, describe (and graph) patterns *in how the harvest corn grew and what else has changed.* **Engage in argument from evidence** by co-constructing a oral & written argument supported by evidence *that plants need water to grow, but they don't necessarily need soil.*	We see a pattern that the different plants grew to different heights. But analyzing the data was particularly tricky because more than one thing was changed in some of the containers we compared to one another. We decided we needed to compare containers where only one thing was different between how they were setup in order to know for certain that the the difference in results was due to one of those things. We decided to refer to this kind of comparison as a fair test. When we compare patterns across fair tests, we see that: • Plants grow better in clean water than dirty water • Plants grow more upright in dirt and water than in dirt alone • Plants don't grow when they have no water, even if they are in dirt. We argued from evidenece that: • Plants must need their roots to be in water to grow, and can only grow in places with water that their roots can reach. This makes sense, as we noticed earlier that the water level was going down. We can think of other examples of things not growing if they don't get what they need, too. For example, a household plant dying because it wasn't watered. • Plants grow more upright when their roots are in soil, but don't need soil to keep growing. From this we can conclude a cause and effect relationship: **"Plants depend on...water...to grow" (LS2.A).** Similarly, **"Living things can survive only where their needs are met" (LS4.C).** *We think we can get more evidence from our remaining experiment (#2) and from any new experiments that we want to design in order to help us figure out else plants need to grow and what else in the environment affects their growth.* ***Next steps: So we still need to look at the results of experiment 2 in L6(b).*** 

Building toward NGSS PEs: 2-LS2-1

Next Lesson....Where we're going Next, students will revisit Experiment #2 to analyze the effects of putting a plant in the dark and another in the light. They will observe both plants and determine that plants also need light to grow.

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Getting Ready: Materials Preparation

Materials For Each Group

- Centimeter Ruler

Preparation of Materials (15 min.)

- Retrieve all four containers that you assembled for Experiment #3: plants with clean water, plants with stinky water, plants with no water, plants with soil and water.
    - Arrange the containers in the room in a line, so students can compare them side-by-side. If possible, allow students to observe the plants from either side of the surface to allow two groups to complete observations at once.
- Make copies of Student Activity Sheet 8b.1
- Post the Notice and Wonder Chart from Lesson 8(a)
- Create a new Notice and Wonder chart for today's lesson
- Create a poster titled, "What Plants Need to Grow." Create two columns, labeling the first with "Plants Need…" and the second with "Our Evidence."
- Post the Investigation Plan Outline chart from Lesson 8(a)

Materials For Each Student

- Lesson 8b - Student Activity Sheets (1)

Safety

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Getting Ready: Teacher Preparation

Background Knowledge

LS2.A from the FRAMEWORK: "Plants depend on...water...to grow.

LS4.C from the FRAMEWORK: "Living things can survive only where their needs are met"

Alternative Student Conceptions

Some students may offer that a variable other than water is responsible for improved or decreased plant growth in the different iterations of Experiment #3.

This is a good opportunity to point out that maybe the experiment that we designed wasn't a"fair test" where only one variable was changed and the rest remained constant. In our experiment, we changed the combinations of water & dirt but maybe we should have only changed one of these things at at- the amount of water, or the kind of water, or the kind of dirt

Encourage students to use this idea to keep this in mind as theycreate improved/revision to our investigation to pursue in their groups in lesson 9a

Linking Our Understanding to Scientific Terminology

- Environment
- Surroundings

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Learning Plan: What have we figured out from Experiment #3? (60-75 min)

1. (10-15 min) Begin with a Consensus Building Discussion [A] so that students can articulate the purpose of Experiment #3 and what we are hoping to figure out from it.

Suggested Prompts:

- ➔ In the last class we designed Experiment #3. What was the purpose of that investigation?
- ➔ What were we wondering about the water?
- ➔ What were we wondering about dirt?
- ➔ What did we keep the same between all the containers?
- ➔ What did we predict would happen to each of the four plants?
- ➔ What should we do with Experiment #3 in class today?

Listen for *student responses* [B] that refer to what we figured out last time, such as:

Experiment #3 was designed to figure out if the stinky water was hurting our corn. We were afraid our plant would die if we left it in the stinky water, but we weren't sure, so we wanted to design an experiment to see if the stinky water is affecting the plant growth.
We decided to put a chunk of our corn cob in clean water, and one in the stinky water.
We also decided to put a chunk of our corn cob in dirt and water and one in just dirt.
All the plants were kept in the light, and all were in the same kind of containers and each had sprouted corn in them.
We had a lot of predictions, but most of us think that the plant that is in the dirt will grow best because that's what most plants grow best in.
Today we need to measure each of the plants in Experiment #3 and compare them to our data from the last lesson so that we can see if they grew.

Teacher Supports & Notes

Strategies for this Consensus Building Discussion

[A] In this Consensus Building Discussion, be sure that all students are clear about why we set up Experiment #3 and what we are hoping to figure out. If students struggle to articulate the purpose of the experiment, share the Notice and Wonder Chart from Lesson 8(a) and draw attention to what we noticed and wondered about the stinky water. Ask students to turn and talk to a neighbor about our class concerns about the stinky water and how we would determine if it was hurting the plants or not.

Additional Guidance

[B] Students have a lot to recall in this Consensus Building Discussion. To save time and increase the amount of participation, you may choose to create an entry slip with these prompts and ask students to fill it out before gathering for the discussion. This will allow you to determine who is unsure of what is going on, and will facilitate you pulling random names to participate in the discussion.

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2. (15 min) Draw students' attention to the four plants that you set up in the room earlier. Give students directions about how to rotate and observe the plants[C]. Remind students of the procedure for measuring the plants and recording their data. Once all groups are clear on the directions, send students off to observe the plants from Experiment #3 and record their data on their Student Activity Sheets.

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3. (15 min) Once all groups have had the opportunity to observe and record their data, gather students back together in front of the new Notice and Wonder chart for today's lesson. Point out that it is really tricky to make comparisons between lots of different results unless we are comparing one set of things at a time. Place different combinations of two different containers in front of you as you ask students the following prompts to engage students in a Building Understandings Discussion:

Suggested Prompts:

- ➔ What did you notice about the plant that we put in clean water compared to the stinky water?
- ➔ What did you notice about the plant that we put in dirt and water compared to the plant we put in clean water?
- ➔ What did you notice about the plant that we put in the dirt and water compared to the plant we put in dirt but no water?

Listen for *student responses* that compare and contrast the plants and their health/growth:

We noticed that the plant in the clean water grew! It looks very healthy. The plant in the stinky water grew, but it doesn't look as healthy. The leaves don't stand up as straight.

We notided the plant in the dirt and the water grew about as long as the plant in the water but no dirt. But the difference was that the plant in the dirt seemed to grow more upright.

We noticed the plant in the dirt without water, brown and yellow and drooping. It looks like it is

Additional Guidance

C You may elect to provide students with another activity to work on while they wait for their group's turn to observe the plants in Experiment #3.

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dying.

Remind students that scientists design and conduct investigations to help figure certain things out. Earlier, the students articulated that we did Experiment #3 to figure out whether or not the stinky water is hurting the plant, but then this led to two different questions, "Do plants grow better in clean water vs. dirty water?" and "Do plants grow better in dirt or not?" Say, "with four different containers, it was kind hard to see patterns, draw conclusions, and make claims because we were changing lots of things at once. We were changing-whether there was water or not and whether the water was clean or not, when it was added, and whether there was dirt or not! . It is much easier to see patterns, draw conclusions, and make claims when we can compare results from where we changed only one thing at a time in the containers

- **Hold up the stinky vs. clean water containers, and ask the prompt below.**
- **Then hold up the dirt & clean water vs. no dirt and clean water, and ask the prompt below.**
- **Then hold up the dirt & clean water vs. the dirt and no water, and ask the prompt below.**

Suggested Prompts:

➔ What is the only thing we changed between these two containers?

Listen for *student responses* that identify what was different in each case

Present the "What Plants Need" chart and fill it out as students come to consensus on ideas that are shared D. Use the following prompts to help students articulate what they figured out:

Suggested Prompts:

➔ So, then is the stinky water or clean water better for plant growth? What containers should we use as evidence to support that?

➔ So, does the plant need dirt in order to grow? What containers should we use as evidence to support that?

Strategies for this Building Understandings Discussion

D As students present their ideas about what plants need, press them for evidence from our work in class to support their ideas. If students disagree, encourage discussion amongst students and remind them to use Talk Moves to respond to ideas as they come up. Before writing anything on the poster, be sure that students agree. You can use a "thumbs-up" vote to determine if you have consensus before adding to the poster.

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➔ So, does the plant need water in order to grow? What containers should we use as evidence to support that?

Listen for *student responses* that offer ideas and support them with evidence from the work students completed in class:

Stinky water isn't as good as clean water for plant growth. We know this because the plant in the stinky water looks less healthy than the plant in the clean water .
It doesn't really need soil to keep growing. We know this by comparing the plant in the water without soil to the plant with soil. Both grew. The only difference is that the plant in the soil seemed to stand upright better.
Plants need water to grow. We know this because the plant that had no water didn't grow at all. In fact, it got brown and yellow and is dying. So even if it has soil, that isn't enough for a plant to grow.

4a. (10 min) Now that students have articulated their conclusions and collected them on the What Plants Need chart, draw students' attention to the Investigation Plan Outline from Lesson 8(a). Ask students to summarize each portion of the Investigation Plan Outline, using the following prompts:

Suggested Prompts:

➔ What were we trying to figure out in our investigation plan? What was our question?
➔ What steps did we agree to take to answer our question?
➔ Did your prediction match what you observed?

Listen for *student responses* such as:

We wondered what environment was best for the corn to grow in. Was water clean water better than dirty water? Does a plant need dirt to grow?
We planted corn in four different environments to see if it grew better in clean water, dirty water, soil with water, or soil with no water at all.

Writing Extension

E In this lesson, we revisit the Scientific Explanation writing, which can later be extended into a more formal informational text through Lesson 8b.we.

As you fill out the chart, be sure that students articulate each row and come to consensus through discussion before you complete any of the writing in the chart. Support students in coming to consensus by encouraging them to go public with their conclusions, being sure to ask them to support their ideas with evidence that you collected as a class. Because students just articulated their findings, refer back to charts from this lesson to support students in drawing conclusions and supporting them with evidence.

Post this chart in the room next to the Investigation Plan Outline for Lesson 8(a). This will help students to see that they have concluded this investigation. This will also serve as a reference for students when they fill out an Investigation Plan Outline and a Scientific Explanation Outline

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Post the Scientific Explanation Writing chart and ask students, "Do we have everything we need to be able to complete this chart?" Listen for students who confirm that they have collected enough evidence to move ahead and fill out the Scientific Explanation Writing chart. Ask students to refer to Lesson 8b Student Activity Sheets and the What Plants Need chart to engage in the shared writing task. Use the following prompts to complete a shared writing that is similar to the text in the image below E:

Claim / Conclusion	**We now know that:** plants need water to grow._____
Evidence	**We know this because:** the plant that was placed in a container with just dirt, but no water did not grow and started to turn brown. But the plant in the container with soil and water grew 4 inches_____

Suggested Prompts:

- ➔ What claim can we make about whether plants need water to grow?
- ➔ What evidence did we collect that supports our claim and proves it is true?

Listen for *student responses* that mimic what is written in the diagram above, such as: .

We can now make the claim that plants need water to grow.
We know this because the only plant that didn't grow in our investigation was the one that didn't get any water at all. The corn in the other environments - clean water, dirty water, and soil with water - all grew almost the same amount!

4b. (10 min) Optional Extension F - Post another Scientific Explanation Writing chart and ask independently in the next lessons.

Additional Guidance

F You may elect to create an additional chart in a writing extension lesson later in the day or the next day.

And there is another explanation that could be written on a third chart, "Does clean water help plants grow more than dirty water?" This was the original question that motivated wanting to look at putting the roots in different things. For that reason it may make sense to come back to it.

Alternatively, you can emphasize that

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students: Can we answer the question, 'Do plants need soil to grow?'

Listen for students who confirm that they have collected enough evidence to move ahead and fill out the Scientific Explanation Writing chart. Ask students to refer to their Student Activity Sheet and the What Plants Need chart to engage in the shared writing task. Use the following prompts to complete a shared writing that is similar to the text in the image below:

Claim / Conclusion	**We now know that:** plants don't need soil to grow._____
Evidence	**We know this because:** the plant in the clean water without soil grew 4 inches. The one in the dirty water also grew, 3.5 inches. The plant in the dirt and water also grew 4 inches. _____

Suggested Prompts:

- ➔ What claim can we make about whether plants need soil to grow?
- ➔ What evidence did we collect that supports our claim and proves it is true?

Listen for *student responses* that mimic what is written in the diagram above, such as: .

We can make the claim that plants don't need soil to grow

We know this because the only plants without soil grew as much as those without. G

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5. (5 min) Before dismissing students, engage students in a discussion about the other investigations they want to keep track of.

Suggested Prompts:

- ➔ What other experiments have we been working on and what do we need to do with these?

sometimes the discoveries we make in an investigation lead to claims that are slightly different than the ones we were trying to design an investigation to test.

Writing Extension

G Students may notice that the plant in the soil grows more upright when its roots are in the soil. If they do, ask "how do the roots in the soil help the plant stay

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➔ What else do we want to do in our next science class?

Listen for *student responses* such as:

We have to check on Experiment #2 to see if our plants need light to grow.
We have other questions about how plants grow on our Notice and Wonder Chart, and we want to investigate those!

upright?" And then follow-up with another question "what might be another function of the roots of the plant besides just getting the plant water?" Students may say, "to help the plant stand upright".

Alignment With Standards

Building Toward Target NGSS PE

- **2-LS2-1.** Plan and conduct an investigation to determine if plants need sunlight and water to grow

Building Toward Common Core Standard(s)

ELA standards
CCSS.ELA-LITERACY.W.2.8
Recall information from experiences or gather information from provided sources to answer a question.
CCSS.ELA-LITERACY.SL.2.1
Participate in collaborative conversations with diverse partners about grade 2 topics and texts with peers and adults in small and larger groups.
CCSS.ELA-LITERACY.SL.2.1.A
Follow agreed-upon rules for discussions (e.g., gaining the floor in respectful ways, listening to others with care, speaking one at a time about the topics and texts under discussion).
CCSS.ELA-LITERACY.SL.2.1.B
Build on others' talk in conversations by linking their comments to the remarks of others.
CCSS.ELA-LITERACY.SL.2.1.C
Ask for clarification and further explanation as needed about the topics and texts under discussion.

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Math standards
CCSS.MATH.CONTENT.2.MD.A.1
Measure the length of an object by selecting and using appropriate tools such as rulers, yardsticks, meter sticks, and measuring tapes.
CCSS.MATH.CONTENT.2.MD.A.3
Estimate lengths using units of inches, feet, centimeters, and meters.

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Lesson 6(b): Why are the different parts growing in different directions?

Teacher Guide

2nd Grade Unit: Why Is Our Corn Changing?

Previous Lesson....Where we've been In Lesson 6(a), students wondered whether or not our corn could grow without light. We planted two parts of our growing cob in new containers and placed one in a dark place to see if it would continue to grow..

This Lesson.... What we are doing now Today we return to the two corn plants we planted in Lesson 6(a) to determine whether or not our corn needs light to grow.

Lesson Question	Phenomena	Scientific Practices	What We Figure Out (CCCs & DCIs), *New Questions* and **Next Steps**	Lesson Level Performance Expectation
L6(b): What did we figure out by putting it in the dark and in the light? 	Day 18 (or later): Results from Experiment 2: The corn cob grown in the light vs. dark has different patterns in terms of the color of leaves, number of sprouts and change in the length of sprouts.	Carrying out investigations Using mathematical thinking (measuring and calculating growth and counting sprouts) Analyzing and interpreting data Arguing from evidence	From Experiment #2, we notice various patterns: • The green shoots/leaves of the plant in the dark are shriveling and turning yellow and brown, but the plant in the light is not. • The plant in the light has more sprouts than the plant in the dark. • The length of the green sprouts in the light and the dark and the ones in the light are longer than the ones in the dark. We decide on cause and effect and structure/function relationships: Since the roots go toward water and the leaves head toward light, we think the plant gets water from its roots and light from its leaves. We see that "Plants also have different parts...that help them survive, grow..." (LS1.A). It is also clear that "Plants depend on...light...to grow" (LS2.A). *We think that light is important for plants to grow, but do they need it as a seed too?* **Based on our evidence so far, we are pretty sure that the plant needs water and light to grow, but now we have some other ideas of experiments we could do to test this. We also have ideas for testing whether there are other things the plant might (or might not need) to grow. We want to start our own experiments next.**	Use mathematical thinking to measure and calculate the growth of the corn plant and the number of visible sprouts. Argue from evidence that plants need light to grow. Building toward 2-LS2-1.

Next Lesson....Where we're going In the next lesson, students will be invited to generate their own questions about plant growth. Ten, they will design investigations to find the answers to their questions.

Engaging in Three Dimensional Learning

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Getting Ready: Materials Preparation

Materials For Each Group

- Centimeter Ruler with half centimeter marks.

Preparation of Materials (15 min.)

- Organize materials in centers so that students can rotate from one center to the next and find all of the materials at each center.
- Post the Investigation Plan from Lesson 6(a) that you completed together as a class.
- Prepare a blank Scientific Explanation Outline on chart paper.
- Center 1:
  - Plant we kept in the light
  - Centimeter Ruler
- Center 2:
  - Plant we kept in the dark
  - Centimeter Ruler

Materials For Each Student

- Lesson 6(b) - Student Activity Sheets (1)

Safety

- None

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Getting Ready: Teacher Preparation

Background Knowledge

LS1.A and LS2.A from the FRAMEWORK:
"All organisms have external parts."

In first grade, students were introduced to the following concepts which will be referenced in today's lesson.

- Examples of external parts are leaves and roots.
    - Leaves and roots have specific **structures and functions**. The leaves are designed to take in light, and the roots are designed to take in water.
- "Plants depend on...light...to grow" (LS2.A).

Alternative Student Conceptions

In some cases, students may believe that the plant we kept in the dark is not thriving due to other factors such as stinky/dirty water, or due to the white mold that grows on the cob. Remind students of the video they watched that helped them come up with the idea to put one plant in the light and one in the dark. Then, remind them that we only changed one variable, the presence of light, keeping all other variables consistent with the plant in the light and the plant in the dark.

Linking Our Understanding to Scientific Terminology

- None

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Learning Plan: What did we figure out by putting it in the dark and in the light? (60 min)

1. (10 min) Begin with a Consensus Building Discussion[A] to help re-orient students in the story line. In this case, students haven't checked on their corn in the dark to do any formal observations, though some students may have been tasked with watering the plant. Use the following prompts to engage students in discussion about what they want to pursue in class today.

Suggested Prompts:

- ➔ Why did we decide to put one plant in the dark and keep one in the light?
- ➔ What did we do with our corn in the light and our corn in the dark?

Listen for *student responses* that refer to what we figured out last time, such as:

We watched a video where we saw a tomato plant that was growing toward the light. This made us think that maybe light has something to do with how our corn grows. We knew that it was important to have something to compare it to, so we planted one part of the cob in the dark, and one part of the cob in the light. We wanted to keep track of how well each plant grew to see if light was important or not.

Now, engage students in a discussion to determine the course of today's lesson.

Suggested Prompts:

- ➔ What do you think we should do to check in on our investigation today?

Listen for *student responses* that refer to what they want to work on today, such as:

We want to observe both of the plants today to see how they did in the light and in the dark. We

Teacher Supports & Notes

Strategies for this Consensus Building Discussion

A In the first part of this discussion, it may be helpful to refer back to the Notice and Wonder chart you captured in Lesson 6(a). If that is unavailable, you may consider showing the video from lesson 6(a) to jog students' memories of the previous lesson.

When students lay out the path of the lesson, be sure they name specifically that they need to measure both plants. Even more important, be sure students articulate that they need to compare the plant kept in the dark to the plant kept in the light.

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need to measure the plants and compare the plant we kept in the light and the plant we kept in the dark.

---

2. (25 min) Organize students into 2 groups. Designate one person or partnership in each group to be in charge of measuring the plants. Pass out the Student Activity Sheets for this lesson and explain the procedure for visiting each of the centers. When students visit each center, they should first take time to observe the plant and sketch what they observe. Remind students to be as specific as possible with their sketches and encourage them to label their sketches. Then, students should write notes about what they notice about the plant. Once everyone in the group has had a chance to observe and sketch, the student(s) in charge of measuring can measure the height of the plant. All students in the group should write down the measurement reported by the measurer. Then, the measurer can count the number of sprouts visible and report this number as well. Once students have all completed their notes and sketches, the groups can rotate.

Before sending students off to carry out their investigation, engage students in discussion around what they should remember as they do their observations B**:**

Suggested Prompts:

- ➔ What should we be sure to do in our sketches today?
- ➔ What should we look for when we observe and write notes about our observations?

Listen for *student responses* such as:

We should sketch as many details as we can, which means we need to take our time! We should label what we see so we know what our sketches mean when we go back to them later.
We should look at the quality of the leaves and stem. We should notice if the plant seems to be healthy or not. We should notice whether or not the plant is growing.

Alternate Activity

B You may choose to split students into more than two groups, creating one or more additional centers to visit in addition to those listed in the lesson.

Strategies for this Building Understandings Discussion

C In this discussion, guide students to connect the evidence they collected through their investigation to the disciplinary core idea that "Plants depend on...light...to grow" (LS2.A)."

If students struggle to come to this understanding, ask them about the exact conditions of the experiment: "What did we take care to do when we set up our experiment? What was the same between both plants? What was different?"

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Send students off to carry out their investigation at each of the centers.

---

3. (10 min) Once students have completed their observations, measurements, and sketches, bring students back together as a whole group for a Building Understandings Discussion C to connect their observations to some bigger ideas. Use the following prompts to engage students:

Suggested Prompts:

➔ What did you notice about the plant at each center? How did they compare?

Listen for *student responses* that share observations from the investigations:

The plant we kept in the light looked healthy. It grew taller than it was before! But the plant we kept in the dark looked unhealthy. It was droopy and the leaves were turning yellow when our plant in the light had green leaves that stood up tall.

Suggested Prompts:

➔ What do our observations tell us about how light affects the way our plants grow?

Listen for *student responses* that connect evidence to the disciplinary core ideas:

We think plants need light to grow because when we took away light and didn't change anything else, our plant became unhealthy.

---

4. (10 min) Refer students back to the Investigation Plan from Lesson 6(a). Read through each piece, asking students to clarify what we decided to do. Use the following prompts to engage students in this process:

Suggested Prompts:

➔ What were we trying to figure out in our investigation plan? What was our question?

➔ What steps did we agree to take to answer our question?

This will draw attention to the fact that light was the only factor we were measuring in this investigation.

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➔ Did you predict correctly?

Listen for *student responses* such as:

We wondered if plants need light to grow.
We decided to plant 2 different pots with corn kernels. The first pot stayed near the window in the light, and the other pot was out of the light in a dark cabinet. We watered both pots the same amount so it would be a fair test.
The people who guessed that the plant would grow better in the light were correct!

Remind students that after they complete an investigation, scientists reflect on what they learned by stating a claim or a conclusion and supporting it with evidence. Post the Scientific Explanation Writing chart and ask students to refer to their sketches and notes on Student Activity Sheet 6(b).1. Use the following prompts to complete a shared writing that matches the image below D**:**

Claim / Conclusion	**We now know that:** plants need light to grow. _____ _____
Evidence	**We know this because:** the plant in the light was green and grew xx inches. But the plant in the dark closet grew xx inches and was turning _____ brown. _____ _____

Suggested Prompts:

➔ What claim or conclusion can we make that helps answer our question from our investigation plan?
➔ What evidence did we collect that supports our claim and proves it is true?

Writing Extension

D In this lesson, we revisit the Scientific Explanation writing, which can later be extended into a more formal informational text through Lesson 6b.we.

As you fill out the chart, be sure that students articulate each row and come to consensus through discussion before you complete any of the writing in the chart. Support students in coming to consensus by encouraging them to go public with their conclusions, being sure to ask them to support their ideas with evidence that you collected as a class. Refer back to any class Notice and Wonder charts or other materials that may assist students with supporting their ideas with evidence.

Post this chart in the room next to the Investigation Plan Outline for Lesson 6(a). This will help students to see that they have concluded this investigation, while others may still be going on.

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Listen for *student responses* that mimic what is written in the diagram above, such as: .

We can now make the claim that plants need sunlight to grow.
We know this because the plant in the light was green and grew a lot, but the plant in the dark started to turn brown and only grew a little bit.

---

5. (5 min) Before dismissing students E, invite students to share any lingering questions, using the prompts below:

Suggested Prompts:

- ➔ What are you still wondering about how light affects the way plants grow?
- ➔ What else do you want to investigate about plant growth?

Listen for *student responses* such as:

We are wondering if seeds need light to grow, or if it's just plants. If they are buried in the dirt, they can't get any light, right?
We have a lot of things that we want to investigate about plants! We want to pursue this by designing our own experiments in the next lesson.

Formative Assessment Opportunities

E Listen for students who build on their experience from this unit to come up with questions for future experiments and investigations. For example, "I know the plant roots suck up water. Would they suck up a different kind of liquid?"

Students are making adequate progress if they make logical jumps to experiments based on evidence they have already collected about plant growth during this unit.

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Alignment With Standards

Building Toward Target NGSS PE

- **2-LS2-1.** Plan and conduct an investigation to determine if plants need sunlight and water to grow

Building Toward Common Core Standard(s)

ELA standards
CCSS.ELA-LITERACY.W.2.8
Recall information from experiences or gather information from provided sources to answer a question.
CCSS.ELA-LITERACY.SL.2.1
Participate in collaborative conversations with diverse partners about grade 2 topics and texts with peers and adults in small and larger groups.
CCSS.ELA-LITERACY.SL.2.1.A
Follow agreed-upon rules for discussions (e.g., gaining the floor in respectful ways, listening to others with care, speaking one at a time about the topics and texts under discussion).
CCSS.ELA-LITERACY.SL.2.1.B
Build on others' talk in conversations by linking their comments to the remarks of others.
CCSS.ELA-LITERACY.SL.2.1.C
Ask for clarification and further explanation as needed about the topics and texts under discussion.

Math standards
CCSS.MATH.CONTENT.2.MD.A.1
Measure the length of an object by selecting and using appropriate tools such as rulers, yardsticks, meter sticks, and measuring tapes.
CCSS.MATH.CONTENT.2.MD.A.3
Estimate lengths using units of inches, feet, centimeters, and meters.

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Lesson 9(a): What else do plants need to grow?

Teacher Guide

2nd Grade Unit: Why Is Our Corn Changing?

This Lesson….What we are doing now: Even though we've figured out several things about plants, we now have individual questions that we would like to explore. For example, we think that leaves might help gather sunlight, but could a plant still grow if all the leaves were cut off? Let's plan an experiment!!

Lesson Question	Phenomena *Days of plant growth*	Lesson Performance Expectation(s)	What We Figure Out (CCCs & DCIs), *New Questions* and ***Next Steps***
L9(a): What else do plants need to grow? (120 min) Recommended over 2 days, 60 min each *Building toward* ⬇ *NGSS PEs:* *2-LS2-1*	Day 21: Materials to design experiments, including already sprouted beans or corn, various seeds etc.	**Design & conduct an investigation** with peers (and teacher guidance if needed), to determine an answer to a question about what else (other causes) do plants need to **grow** (effect)**?**	**Experiment #4: We get ready to plan our experiments to answer some of our own questions.** **We review the questions from all of notice and wondering charts, and pick some of them from a gallery walk as candidates we might be interested in investigating further.** **As a group we decide *on our question*, materials and tools, and procedure in our investigation plan. We also decide what data we want to keep track of. For example, some students may need to measure the green sprout growth or root growth, others might need to measure how much water they are adding every day or count how many plants turn brown.**  My own groups' question. (Experiment 4)

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Getting Ready: Materials Preparation

Materials For Each Group

- Chart paper with an Investigation Plan Outline prepared for every group
- Unique to each group
- Use clear plastic cups as the vessel for corn plantings

Preparation of Materials (15 min.)

- Chart Paper titled, "Our Questions about the Corn"
- Post previous Investigation Plan Outlines from previous lessons
- Sticky notes for peer feedback
- Prepare a set of materials that students can use in their experiments
    - Various seeds, soil, empty containers (clear plastic cups), rulers, measuring cups, scissors, sprouted plants with leaves, etc.

Materials For Each Student

- Lesson 9a - Student Activity Sheets (1)

Safety

- Depends on supplies available to your class. Provide students with appropriate safety guidelines.

Getting Ready: Teacher Preparation

Background Knowledge

- See all the unpacking from the storyline

Alternative Student Conceptions

None

Linking Our Understanding to Scientific Terminology

- Control group

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Learning Plan: What else do plants need to grow? (120 min)

Teacher Supports & Notes

1. (5 min) Begin with a Consensus Building Discussion to help re-orient students in the story line. Use the following prompts to help students articulate what they figured out in the last lesson.

Suggested Prompts:

- ➔ What did we figure out last class? (Refer to results of experiment #3)
- ➔ How did we know that? What evidence did we have?
- ➔ What did we decide that the roots and leaves do?

Listen for *student responses* that refer to what we figured out last time, such as:

We figured out that plants need light to grow because our plant that we moved into the dark turned yellow and brown. We think it's dying. We also decided that since the roots grow toward the water, and we know that plants need water, the function of the roots is probably to help the plant get water. Since the leaves grew towards the light in the video, and we know that plants need light, the function of the leaves is probably to get light for the plant.

2a. With students still gathered, use the chart paper you prepared titled, "Our Questions about the Corn" to collect a list of the questions students still have about what plants need to grow, or about the corn. Use the following prompts to find out what students are still wondering about.

Suggested Prompts:

- ➔ Do you have any other questions about what plants need to grow?
- ➔ Is there anything you are wondering about?
- ➔ Did finding anything out from last class make you think about anything else?

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Listen for *student responses* that anticipate the next step in the story line, such as

We actually have a lot of questions still that we haven't figured out!

Answers will vary according to the types of questions students still have. Expect students to offer questions such as:

We're pretty sure a plant gets water through it's roots, but could it get water through its leaves if it had to?

We know that a plant needs sunlight when it's already grown, but does it need it as a seed too to start a baby plant?

Do roots grow longer in different types of soil?

We saw that leaves bend towards light, could roots bend towards water?

Is water the best liquid to grow a plant in?

Are there any interesting questions on the Notice and Wonder charts that have not been answered yet?

2b. (10 min) Next, shift to a Sharing Initial Ideas Discussion[A]. Use the following prompts to guide students to articulate what they think they should focus on in today's lesson.

Suggested Prompts:

- ➔ What do scientists do if they have a question that they want to find an answer to?
- ➔ What could we do in our class to find out the answers to some of these questions?

Listen for *student responses* that anticipate the next step in the story line, such as

We think scientists design investigations and experiments when they want to answer questions.

We would like to design our own experiments to test our own questions, just like scientists do.

---

3. (10 min) Give students a chance to provide feedback about which of the questions they find most compelling on Student Activity Sheet 9(a).1. Then, determine which of the questions will

Strategies for this Initial Ideas Discussion

A If your students get stuck in this discussion, you can pull out previous Notice and Wonder charts with good questions on them that the class hasn't been able to investigate. You could even preview the old Notice and Wonder charts and circle questions you think the students might find interesting and investigatable in the classroom.

Differentiation Strategies and Alternate activities

B At this point in the lesson, the teacher may elect to engage the class in the decision about which questions they will pursue as a class. It is important to discuss with students the qualities of a "testable" question, considering the unique constraints of their 2nd grade classroom. Alternatively, teachers may elect to choose the questions that are testable, then share a list of these questions with students. At this point, students can vote on the questions they would like to see tested in their classroom, and the teacher can allow for as many groups as is convenient for their classroom space and number of students. Teachers may also choose a limited number of

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be pursued by each design team[B].

Once the questions have been selected, place students in teams, and assign each team to one of the questions that you recorded on the "Our Questions About the Corn" chart. Once students are in their groups, ask them to record their assigned question on the top of Student Activity Sheet 9a.1.

---

4. (45 min) After students have been assigned a question to investigate they should begin planning on how they can test their experiment. Allow students to access all the materials you have available for students to use. These can be: empty containers, various types of soil, rocks, different seeds, sprouted plants, rulers, measuring cups etc.

Use the following prompts to scaffold the work students do to complete Student Activity Sheet.

Suggested Prompts:

- ➔ Remember, this is not the time to actually start your experiment! Instead, you and your teammate(s) are looking through the supplies and asking, "How could we design an experiment to test our question with the materials we have?"

Give students a chance to talk in their teams about the type of experiment they would want to design. Let students know that they will get a chance to sketch out their designs once they have settled on more of the details.

Have them first focus on the question they want to answer and record that in their activity sheets.
Then, have students complete the materials list for their experiment in Step 2 of the Student Activity Sheets of all of what they will need to conduct this investigation.

Next, ask students to fill out Step 3 of the Student Activity Sheets with a labeled sketch of what

questions and have multiple teams working on each question.

Additional Guidance

[C] Decide if you want to introduce this phrase to students to refer to the second condition they will compare to. If you do introduce it, add it to the science word wall.

Alternatively, you can simply emphasize that there must be at least two plantings or two conditions to set up. One of them should be the plant that is potted without adding the thing you think might affect its

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their experiment would look like and what materials would be used. Here students will also sketch the comparison (control) in the experiment.

Lastly, prompt students to consider what they will measure, and how they will compare their experiment to a second condition (a control group). Students should select one or more changes that they will measure in their experiment. Then, students need to explain how they will know that the variable they changed (amount of water, amount of light, type of soil, etc.) is making a different impact to the way the plant grows than to a typical situation.

Guide students in making a decision about how they will measure which one of their experimental groups changes more.

Suggested Prompts:

- When we were testing "Do plants need light to grow?" we measured the change of how tall the plants got and what color the leaves turned. We placed one plant in the light and one plant in the dark so that we could compare which one grew better.
- What will you measure in your experiment?
- What two (or more) groups will you compare in your experiment?
- How will you make sure your experiment is a fair test?

Have students fill out step 4 of the Student Activity Sheet with what they plan to measure about their plants in the coming days and how they will measure it. Circulate and assist, making sure that students are choosing from the available materials.

As small groups are working, circulate and assist to support groups with their experimental design by using the suggested prompts listed below.

Suggested Prompts:

growth, the other should be the plant potted with adding the thing you think might affect its growth.

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- ➔ What evidence do we need to collect...?
- ➔ What type of data would we need to analyze..?
- ➔ What do you think we should do next...?
- ➔ How could we go about...?
- ➔ What would we need to be able to...?
- ➔ What could we do to...?
- ➔ How could we investigate...?
- ➔ What materials could we experiment with to investigate our question…?
- ➔ How would we measure (X)?
- ➔ How should we keep track of...?

---

5. (15 min) Once students have settled on these four parts of their experimental design, guide students to Step 5 of the Student Activity Sheet. Ask each group to fill in the Investigation Plan Outline, using the charts from previous lessons as a guide. Circulate and assist as students use Steps 1-4 of Student Activity Sheet to help them fill in the Investigation Plan Outline.

---

6. (10 min) Once students have completed their Investigation Plan Outlines, post them around the room. Give all students some post-it notes, and instruct them to conduct a gallery walk. Students will circulate around the room, reading the Investigation Plans for their peers, writing any feedback D they have on the sticky notes, and posting the sticky notes on the corresponding Investigation Plan.

---

7. (15 min) Allow time for teams to revise their experimental designs based on class feedback. Make sure each team gets their experimental design approved by the teacher before continuing.

Strategies for this Building Understandings Discussion

D Feedback from students should be focused on the following questions:

- Is the team comparing two groups of experiment set ups (is there a control)?
- What type of data is the group collecting? Is the type of data they they are collecting a good way to answer their question? How are they collecting and keeping track of the data?
- Does the team have a prediction of what they think will occur?

You may want to model for students one positive comment and one constructive comment focused on content. You can give them "starters" A "star": complement and a "step" what question do they have? Or what is something about the plan they don't understand?

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E

Before releasing the students, ask them to think about what we should do next.

Suggested Prompts:

➔ What should we make sure we do in our next science class?

Listen for *student responses* such as:

We need to start our experiments!

Formative Assessment Opportunities

E Students should have a logical procedure to test their question. These pieces written out on the Student Activity Sheet 9a. can be used as a formative assessment.

Alignment With Standards

Building Toward Target NGSS PE

- **2-LS2-1.** Plan and conduct an investigation to determine if plants need sunlight and water to grow

Building Toward Common Core Standard(s)

ELA standards
CCSS.ELA-LITERACY.W.2.8
Recall information from experiences or gather information from provided sources to answer a question.
CCSS.ELA-LITERACY.SL.2.1
Participate in collaborative conversations with diverse partners about grade 2 topics and texts with peers and adults in small and larger groups.
CCSS.ELA-LITERACY.SL.2.1.A
Follow agreed-upon rules for discussions (e.g., gaining the floor in respectful ways, listening to others with care, speaking one at a time about the topics and texts under discussion).
CCSS.ELA-LITERACY.SL.2.1.B
Build on others' talk in conversations by linking their comments to the remarks of others.
CCSS.ELA-LITERACY.SL.2.1.C

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	Ask for clarification and further explanation as needed about the topics and texts under discussion. Math standards CCSS.MATH.CONTENT.2.MD.A.1 Measure the length of an object by selecting and using appropriate tools such as rulers, yardsticks, meter sticks, and measuring tapes. CCSS.MATH.CONTENT.2.MD.A.3 Estimate lengths using units of inches, feet, centimeters, and meters.

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Lesson 9b: How much did my plants change?

2nd Grade Unit: Why Is Our Corn Changing?

Teacher Guide

Previous Lesson ...Where we've been: In the last lesson, your students planned out their independent research investigations in detail. They have thought through a question to investigate, how to set-up their investigation and the data they will need to collect.

This Lesson....What we are doing now: Students will carry out their independent research experiments. They will be collecting data they decided was relevant to their research question and begin to analyze their data for patterns. They may need support from you to problem solve roadblocks that arise.

Lesson Question	Phenomena *Days of plant growth*	Lesson Performance Expectation(s)	What We Figure Out (CCCs & DCIs), *New Questions* and ***Next Steps***
L9(b): How much did my plants grow?  (45 min) +15 min every other day for 10 to 12 days *Building toward* ⬇ *NGSS PEs:* *2-LS2-1*	Day 22-31: Observations from our own experiments.	**Analyze data** *(Noticing)* **and use mathematical thinking** to record observations, measure lengths, and, describe (and graph) patterns *in how the much each of the plants in the group's different conditions* ***grew and changed.***	**We carry out our investigations and are continually collecting data over the next 9-10 days.**

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Next Lesson ...Where we're going: Once students collect enough data (~9-10 days later), they will try to analyze the data and construct an evidence-based argument from it to answer their original investigation question in preparation for sharing their findings with their classmates.

Getting Ready: Materials Preparation

Materials For Each Group

- Each group will need materials depending on their experiment

Preparation of Materials (15 min.)

- Students should have listed the type and quantity of the materials they need in the Student Activity Sheet 9a.1 to begin their individual experiments. Refer to these documents of the students to prepare the necessary materials.
- Designate a space for each team to start setting up their experiment and a space for them to place their experimental set-ups by the end of the class based on each group's needs.

Materials For Each Student

- Lesson 9b - Student Activity Sheets 1)

Safety

- Safety concerns depend on each group's experiment.

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Getting Ready: Teacher Preparation

Background Knowledge

- Unique to each group

Alternative Student Conceptions

Linking Our Understanding to Scientific Terminology

- Data

Learning Plan: How much did my plants change? (45 min) + 15 min every other day for ~ 10 days

1. (5 min) Begin with a Consensus Building Discussion to help re-orient students in the story line. Guide students to refer to Student Activity Sheets from the previous lesson (Lesson 9a) to help them answer the prompts. Use the following prompts to help students articulate what they figured out in the last lesson.

Suggested Prompts:

- ➔ In general, what did each team figure out in our last lesson?
- ➔ What did we plan out in our Student Activity Sheets from Lesson 9a last time?

Listen for *student responses* that refer to what we figured out last time, such as:

When each team got their question, we had to figure out a few things. First, we needed to decide what we were going to measure. We also had to figure out what to compare our experiment against to see the how the variable we chose changed. We came up with a list of materials and

Teacher Supports & Notes

Additional Guidance

A If students already have the word "Data" in their vocabulary, this is not necessary to discuss. If they do not have this science vocabulary word, and do not know what scientists call those measurements, it's okay to label this word for them now that have build up the conceptual understanding throughout the unit of what data is and how it's used.

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sketched out what our experiments would look like. Finally, we filled out an Investigation Plan Outline with our question, the steps we will take, and a prediction.

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2. (5 min) Next, shift to a Sharing Initial Ideas Discussion. Use the following prompts to guide students to articulate what they think they should focus on in today's lesson .

Suggested Prompts:

- ➔ Where do you think we are heading next?
- ➔ Think back to all our experiments that we did throughout this unit. We collected a bunch of measurements. What did we do with those measurements?
- ➔ When we make our measurements and use the measurements to tell us something about our experiment, does anyone know what scientists call all those observations or numbers we collect[A] ?

Listen for *student responses* that mimic the next step in the story line, such as

Let's set up our experiments and start to take our measurements! Sometimes we put our measurements into charts. Sometimes we looked at the plants with our eyes and use that information to tell what was happening to the plants. We call those measurements our data.

---

3. (20 min) Have them gather their materials and allow students to set up their experiments in their designated space. Remind students to use their sketches in Student Activity Sheet 9(a).1 as a guide. Be sure that it is clear that students are simply setting up their experiments, not conducting the experiments yet.

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4. (10 min) After teams have finished setting up their experiments, gather them together for a

Strategies for this Building Understandings Discussion

B Here we would like students to articulate why we should start measuring

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building understandings discussion.

Suggested Prompts:

- ➔ We know that we need to collect some data now that we have set up our experiments. When do you think we should start taking our measurements?
- ➔ If we start taking our measurements in our next science class, would we know if our plants/groups changed from now until then? Why?
- ➔ So if we wanted to be able to tell if our plants changed or not, between today and tomorrow, when do you think we should start measuring?

Listen for *student responses*, such as:

We should probably start taking measurements in our next science class. Well, if we start measuring tomorrow we wouldn't know if something really changed yet because we wouldn't have anything to compare it against, or maybe we would if we remembered what our plants looked like today. So I guess if we want to be able to tell if something has changed in our next science class, then we need to start taking measurements today.

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5. (5 min) Have the students go back to their experimental set-ups and record their first measurements in a data table using the Student Activity Sheet 9(b).1.

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6. (5 min) After students have recorded their measurements, help them anticipate the next row of the storyline.

Suggested Prompts:

- ➔ What should we continue to do over the next few science classes?
- ➔ After we are done making measurements what should we do with that data?

our plants today. We need a "zero" data point because we can't tell if our plants changed. The first point to help students move towards this idea is that you can't tell if something has changed if you don't have anything to compare it to. Use talk moves to bring these ideas out into the class.

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Listen for *student responses* such as:

➔ *We need to continue to collect measurements on our experiments. When we're all done collecting data, then we probably should look really closely at it and try to identify patterns, analyze it to understand our results.*

Future days - allow this step every other day for about 10 to 12 days:

7. (15 min each day) Give students time every couple days to make observations and measurements and add their observations/results to these student activity sheets for this lesson.

Alignment With Standards

Building Toward Target NGSS PE

- **2-LS2-1.** Plan and conduct an investigation to determine if plants need sunlight and water to grow

Building Toward Common Core Standard(s)

ELA standards
CCSS.ELA-LITERACY.W.2.8
Recall information from experiences or gather information from provided sources to answer a question.
CCSS.ELA-LITERACY.SL.2.1
Participate in collaborative conversations with diverse partners about grade 2 topics and texts with peers and adults in small and larger groups.
CCSS.ELA-LITERACY.SL.2.1.A
Follow agreed-upon rules for discussions (e.g., gaining the floor in respectful ways, listening to

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others with care, speaking one at a time about the topics and texts under discussion).
CCSS.ELA-LITERACY.SL.2.1.B
Build on others' talk in conversations by linking their comments to the remarks of others.
CCSS.ELA-LITERACY.SL.2.1.C
Ask for clarification and further explanation as needed about the topics and texts under discussion.

Math standards
CCSS.MATH.CONTENT.2.MD.A.1
Measure the length of an object by selecting and using appropriate tools such as rulers, yardsticks, meter sticks, and measuring tapes.
CCSS.MATH.CONTENT.2.MD.A.3
Estimate lengths using units of inches, feet, centimeters, and meters.

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Lesson 9(a): Why are the different parts growing in different directions?

Teacher Guide

2nd Grade Unit: Why Is Our Corn Changing?

This Lesson….What we are doing now: Today we wrap up our investigations by collecting and analyzing our data. We will use this data as evidence to explain what we learned about the structures of the corn plants and the functions of each of those structures. And we start writing up our results to share with our classmates.

Lesson Question	Phenomena *Days of plant growth*	Lesson Performance Expectation(s)	What We Figure Out (CCCs & DCIs), *New Questions* and ***Next Steps***
L9(a): What did our group figure out from our investigation?  (120 min) Recommended over 2 days, 60 min each *Building toward* *NGSS PEs: 2-LS2-1*	Day 32-34: The results of our experiment and our own group's claim(s).	**Engage in argument from evidence** by constructing a written argument supported by patterns *in the group's data (evidence) that answers the group's question about what else (other causes) do plants need to* ***grow*** *(effect)****?***	Now that we have our results, we are so excited about our results! We want to share what we learned with others, and want to hear what they figured out too. *This raises a new question: How can we communicate what we learned?* We agree that others will want to know more than just our discoveries, they will want to know how we figured it out, and the question that motivated the investigation. We decide that writing up our findings using what we learned about how to write an investigation plan and an evidence-based claim in earlier investigations would be a good approach. We decided to refer to these two things as our "Discoveries Report" We refer to our worked examples from Lesson 4a, 4b, 6a, 6b, 8a, and 8b, that are posted in the room to outline our own writing and model for what we want to share with other classmates what we did and what we learned from it, and to hear what they did and learn from them. ***Next steps: We want some time to finish constructing our discoveries report. And then we want time to to share these with our classmates and others who might be interested.*** *Maybe some of our parents or other teachers might want to drop in to hear about what we figured out?*

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Getting Ready: Materials Preparation

Materials For Each Group

- Any materials students have used for the experiments they designed in Lesson 9(a)
- Their completed Lesson 9a - Student Activity Sheets.

Preparation of Materials (15 min.)

- Organize the space so that all students have space to examine their experiments they designed in Lesson 9(a).
- Post any Scientific Explanation Outline Charts from previous experiments in the unit for reference.

Materials For Each Student

- Lesson 9c - Student Activity Sheets (1)

Safety

- Discuss with students any safety measures that need to be taken when working with their own experiments (if appropriate).

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Getting Ready: Teacher Preparation

Background Knowledge

LS1.A from the FRAMEWORK: "Plants also have different parts (roots, stems, leaves, flowers, fruits) that help them survive and grow."

In first grade, students were introduced to the following concepts which will be referenced in today's lesson.

- Plants have roots, stems, and leaves that help them grow.
- Each of these structures has a particular function.

Alternative Student Conceptions

Linking Our Understanding to Scientific Terminology

- Claim
- Evidence

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Learning Plan: What did our group figure out from our experiment? (60 min)

1. (10 min) Begin with a Consensus Building Discussion[A] to guide students to articulate the direction of today's lesson using the following prompts.

Suggested Prompts:

- ➔ We have been working with our experiments for a few days now. Why did we set up those experiments?
- ➔ Do we have enough data collected to answer the questions we decided to investigate?
- ➔ What should we do if we have enough data? What should we do if we do not have enough data?

Listen for *student responses*[B] that refer to what we figured out last time, such as:

We set up our own experiments because we still had questions about how plants grow and we wanted to figure out the answers to those questions. Some of us feel like we have enough data collected to answer our questions, but some of us do not. If we do have enough data collected, we need to figure out what the data tells us. If we don't have enough data, we should collect more.

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2. (10 min) Next, shift to a Sharing Initial Ideas Discussion[C]. Use the following prompts to guide students to articulate what their group will do with their experiments today.

Suggested Prompts:

- ➔ If you think you have already collected enough data, what will you do to draw conclusions from your data today?[D]
- ➔ If you have not collected enough data, what steps will you take to gather enough data and use it to draw conclusions?[D]

Teacher Supports & Notes

Strategies for this Consensus Building Discussion

A The Consensus Building Discussion is particularly important at this stage in the unit, as students have assumed responsibility of their own experiments. They need to be the ones to determine what should happen next as they investigate their questions. We also want students to use the questions they wanted to figure out as the gauge for whether or not they are ready to wrap up their experiments. This means they will have to collect and analyze data today.

Strategies for this Consensus Building Discussion

B The goal of this discussion is to put students in the driver's seat. Use the prompts to help students recall and restate what we as a class figured out in the last lesson. Their ideas should motivate what we are going to need to do next, in this lesson.

Differentiation Strategies and Alternate Activities

C If this is students' first experience with

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Listen for *student responses* that mimic the next step in the story line, such as:

Our group will look at all of the Student Activity Sheets from the last few lessons and re-read our observations. We will try to use these to figure out the answer to our question.

Our groups will collect more data on our Student Activity Sheets. Then we will re-read the data we collected and try to draw some conclusions about it to answer our question.

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3. (10 min) Set students off to carry out the work they articulated in step 2. Circulate and assist as needed. Watch for groups who struggle to draw conclusions from their data and observations. Reinforce as needed the idea that we need to use our question as our guide for our data analysis. What is the answer to our question, and what is our evidence for that claim?

When students have completed their observations, gather them back together as a whole group, seated close to their groups members. Groups can create posters to show their findings with their claim and evidence to share to the class. (share out)

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4. (15-25 min) Hand out Student Activity Sheets for this lesson. Refer to the previous Scientific Explanation Outline Charts you've posted to remind students that scientists make claims/draw conclusions about their experiments and support their claims with evidence. Send students off to work in teams to fill in the Scientific Explanation Outline. Circulate and assist to ensure students are making logical claims that are based on observable evidence from their experiments.

When students have completed their Scientific Explanation Outlines and you approve them, send students to a place where they can work individually to complete the Exit Questions on Lesson 9c - Student Activity Sheets E **.**

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designing and conducting investigations to answer self-selected questions, they may be unsure of what to do with the data once it is collected. In this case, you may want to share a video or reading to help them understand that scientists use the data they collect from tests and observations to draw conclusions. The Framework states, "The goal of science is the construction of theories that provide explanatory accounts of the world." It is critical that students are aware of the purpose of the work they do to collect data in their investigations.

Strategies for this Initial Ideas Discussion

D While the two paths are very similar, be sure students can confidently articulate the tasks and priorities for their group. With so many different experiments running at once, this will ensure that students need less of your help so that you can circulate and ask probing questions as needed.

Formative Assessment Opportunities

E The Exit Questions on Student Activity Sheet 9(c) are designed as an assessment opportunity. These can be used to determine if students truly met the Performance Expectation for this unit, which

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5. (5 min) Conclude the lesson by inviting students to share with a neighbor their answers for the Exit Questions.

states: "Plan and conduct an investigation to determine if plants need sunlight and water to grow."

Students have demonstrated mastery of the PE when they have constructed an explanation that uses what they learned from all of the experiments in this unit to answer questions 4 and 5.

Alignment With Standards

Building Toward Target NGSS PE

- **2-LS2-1.** Plan and conduct an investigation to determine if plants need sunlight and water to grow

Building Toward Common Core Standard(s)

ELA standards
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Recall information from experiences or gather information from provided sources to answer a question.
CCSS.ELA-LITERACY.SL.2.1
Participate in collaborative conversations with diverse partners about grade 2 topics and texts with peers and adults in small and larger groups.
CCSS.ELA-LITERACY.SL.2.1.A
Follow agreed-upon rules for discussions (e.g., gaining the floor in respectful ways, listening to others with care, speaking one at a time about the topics and texts under discussion).
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Lesson 9(d): What has our class figured out from all of our experiments?

Teacher Guide

2nd Grade Unit: Why Is Our Corn Changing?

T	**This Lesson….What we are doing now:** Today we will share our findings with our classmates, using our Discovery Report as a guide. We will summarize all of the cause and effect relationships we learn about as our classmates share the results of their investigations.

Lesson Question	Phenomena *Days of plant growth*	Lesson Performance Expectation(s)	What We Figure Out (CCCs & DCIs), *New Questions* and ***Next Steps***
L9(d): What has our class figured out from all of our investigation? (60 min) S *Building toward* ⬇ *NGSS PEs: 2-LS2-1*	Day 35-36: The results of all of our groups' different experiments.	**Communicate information** with others *(classmates and guests)* presenting in oral and written forms using models, drawings, and writing, about *our research question, our investigation plan, the patterns in our data we collected, and the claims we can make based on this evidence about what else (other causes) plants need to **grow** based on that evidence.* **Engage in argument from evidence** by listening actively to arguments to indicate agreement or disagreement based on evidence, and/or to retell *the claim about plant growth that each group is making and the patterns in their data (evidence) that supports their claim.*	We shared our findings and heard from other groups. We restated what their discoveries were and the how the evidence they collected supported their claims. Our teacher kept track of these discoveries of the whole class, summarizing in a cause and effect relationships like: • Plants grow better with sunlight. • Plants grow with other types of light. • Plants need light to keep growing. • Plants need water to keep growing. • Seeds need water to start growing. • The environment that the plants grow in is important. • Soil might be important to helping plants grow. • Every time we start a new experiment we see the same patterns happening, even if we all planted different types of plants. Little white things shoot up out of the seed, some white things shoot down. The white things that were up, start to turn green and become wide, flat, and tall. They also will bend towards the light. Plants look different from when they were younger, which means that they must grow in a similar way. **("Plants...have predictable characteristics at different stages of development." (LS1.B))**

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Getting Ready: Materials Preparation

Materials for the Whole Class

- None

Preparation of Materials

- None

Materials for Each Student

- Lesson Plans 9d - Student Activity Sheets (1)

Safety

- None

Getting Ready: Teacher Preparation

No special preparation necessary

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Learning Plan: What has our class figured out from all of our experiments? (135 min)

1. (5 min) Set norms for the presentations if students have not presented to their classmates before. You may wish to set norms for being an audience member, such as listening quietly, or taking notes on the Lesson 9d Student Activity Sheets (optional) , and leaving questions until the speaking group is done with their presentation.

Emphasize that students need to be able to restate the question the group was investigating, or the claim that they made, or the evidence that supported that claim after each group presents.

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2. (130 min) Have all groups present their findings in turn. During the presentation, students can take notes on the other groups' ideas on Student Activity Sheets (optional).

Call on different audience members after each presentation to restate these ideas, giving a different student a chance to respond to a different one of these things ThisBuild on others' talk in conversations by linking their comments to the remarks of other

Also allow time for students in the audience s to ask questions, with the presenting group. The presenting group can be instructed to take and answer 1-3 questions.

Teacher Supports & Notes

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