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Teacher Guide: A Plant Cell VR Simulation

Key:
*** Pedagogical approaches as carried out by instructional routines and protocols are highlighted in orange. Click on them to learn more about how to approach it in your classroom.**
*** Accompanying student-friendly worksheets are highlighted in blue. Click on anything in blue for a printable or digital customizable student resource.**

Objectives and Standards	**Objective**: Students will be able to explore a plant cell's structures and functions by engaging in a VR experience. **Skills + Themes Addressed:** - Using a model - Structure and Function Relationships - Engaging in an Argument from Evidence **Spirit**: https://www.inspiritvr.com/viewspirit/a-plant-cell-vr-simulation
Suggested Time Frame: 2 class blocks, or 2 (50 minute) periods	**Engage**: Written Question using the protocol **"Draw It and Share!"**: What do you think a plant cell looks like?" Students may use the worksheet linked here. *Answer*: Student responses will vary. Use this time to resurface any prior student understandings, especially calling attention to misconceptions. Students might have used the color green or drawn a leaf. This would be a good time to review that cells are tiny structures, and that they are not visible to the naked eye. **Explore & Explain:** Students will be exploring a simulation in VR. Use this Plant Cell VR Protocol to support your students as they engage in the expedition. **Instructional Protocol: Exploring a Plant Cell in VR** **Student Worksheet: Exploring a Plant Cell in VR** **Evaluate**: Part 1: Summary Question

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	How do you think the organelles within a plant cell work together to maintain homeostasis for a plant? Key Vocabulary: 1. *Organelle*: Part of a cell with a specific function 2. *Maintain homeostasis*: keeping balance or equilibrium within a living organism Link to Worksheet Part 2: Engaging in argument from evidence. Key Question: Do you believe a plant cell needs to have all of its organelles in order to function? Why or why not? Link to CER Instructional Template Link to Speaking Routine for Discussion Link to CER Rubric Part 3: Practice Questions Link to Worksheet

Draw It and Share Protocol

1. Take out any coloring utensils (markers, crayons, pens, pencils), and give students blank white paper for brainstorming. Alternatively, give students an open or blank virtual canvas page or blank google doc.
2. Ask students to think about one specific phenomenon, model, or image and begin to draw it.
3. Give students 2-3 minutes to work through the discomfort of being incorrect so that they can begin to draw.
4. Share: Pair each student with a partner close to them in proximity. Have them discuss their thinking with their partners for a set amount of time (around 3-4 minutes).

Reminders:

- Keep in mind differing student needs as they work together and independently. Students may prefer to write what they would see in the model or phenomenon in words instead. Encourage them to be creative.

VR Instructional Protocol: Plant Cell

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1. Group students in groups of 2-4 homogeneously or heterogeneously, depending on your student needs and the number of VR headsets allowable for use in one setting.
2. Assign one VR headset per group.
3. Have students choose a number, from 1-4, depending on the size of a group. This number will determine the order in which students will be able to explore within the headset.
4. Student 1 will put on the headset and begin the simulation. The student will pluck a leaf and then put it in the pod, and then stand in the column to enter into the plant cell. The student will then take a look around and make initial observations of the cell. After completing the initial exploration, student 1 will share answers to the following questions within the group and on their student worksheet. After completing this step, the student will remove the VR headset and pass it to the next student. They will answer:
    a. What did you notice about the initial plant before plucking the leaf?
    b. What are your initial observations of the colors and parts of the cell?
    c. What are the main structures of the chloroplast? What is its function?
5. Student 2 will put on the headset and begin to explore the mitochondria, peroxisome, and vacuole. Student 2 will then share observations with the group. After completing the vacuole, the student will remove the VR headset and pass it to the next student. They will answer:
    a. What are the main structures of the mitochondria? What is its function?
    b. What are the main structures of the peroxisome? What is its function?
    c. What are the main structures of the vacuole? What is its function?
6. Student 3 will put on the headset and begin to explore the golgi body and cytoskeleton. Student 3 will then share observations with the group. After completing the cytoskeleton, the student will remove the VR headset and pass it to the next student. They will answer:
    a. What are the main structures of the golgi body? What is its function?
    b. What are the main structures of the cytoskeleton? What is its function?
7. Student 4 will put on the headset and begin to explore the cytoplasm and cell wall. Student 4 will then share observations with the group. After completing the cytoskeleton, the student will remove the VR headset as the experience has now concluded. They will answer:
    a. What are the main structures of the golgi body? What is its function?

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b. What are the main structures of the cytoskeleton? What is its function?

Student Worksheet: Plant Cell VR Experience
Spirit: https://www.inspiritvr.com/viewspirit/a-plant-cell-vr-simulation

Engage: Draw It! What does a plant cell look like?

Explore + Explain: The VR Experience
Student 1 will put on the headset and begin the simulation by plucking a leaf and then putting it in the pod, and finally stand in the column to enter into the plant cell. Take a look around and make initial observations of the cell. Take a look at the cell as a whole and the chloroplast. After completing this step, remove the VR headset and pass it to the next student. Answer the following questions before the next student begins.

1. What did you notice about the initial plant before plucking the leaf?
2. What are your initial observations of the colors and parts of the cell?
3. What are the main structures of the chloroplast? What is its function?

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Student 2 will put on the headset and begin to explore the mitochondria, peroxisome, and vacuole. Student 2 will then share observations with the group. After completing the vacuole, the student will remove the VR headset and pass it to the next student. They will answer:

1. What are the main structures of the mitochondria? What is its function?

2. What are the main structures of the peroxisome? What is its function?

3. What are the main structures of the vacuole? What is its function?

Student 3 will put on the headset and begin to explore the golgi body and cytoskeleton. Student 3 will then share observations with the group. After completing the cytoskeleton, the student will remove the VR headset and pass it to the next student. They will answer:

1. What are the main structures of the golgi body? What is its function?

2. What are the main structures of the cytoskeleton? What is its function?

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Student 4 will put on the headset and begin to explore the cytoplasm and cell wall. Student 4 will then share observations with the group. After completing the cytoskeleton, the student will remove the VR headset as the experience has now concluded. They will answer:

1. What are the main structures of the golgi body? What is its function?

2. What are the main structures of the cytoskeleton? What is its function?

Evaluate Part 1:

How do you think the organelles within a plant cell work together to maintain homeostasis for a plant?

Organelle: Part of a cell with a specific function
Maintain homeostasis: keeping balance or equilibrium within a living organism

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Evaluate Part 2:

Do you believe a plant cell needs to have all of its organelles in order to function? Why or why not?

Fill out the table below by creating a claim, and backing it up with your own evidence, and reasoning. Be sure to keep in mind that you will be engaging in a discussion with your classmates on the topic.

Claim *Sample*: I believe plants do/do not need all of their organelles in order to survive.	**Evidence**	**Reasoning**

Evaluate Part 3:

Match the organelles with their functions.

Organelle	**Function**
___Cell Wall	An organelle that helps with waste.
___Peroxisome	A rigid outer layer of a plant cell.
___Mitochondria	An organelle responsible for creating glucose.

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___Chloroplast	An organelle responsible for creating ATP.
___Rough ER	An organelle made of mostly water.
___Cytoskeleton	Responsible for making and packaging proteins.
___Vacuole	A structure that helps to give the cell shape.

Multiple Choice Questions:

1. Which organelle helps to control all of the activities of a cell?
    a. Nucleus
    b. Mitochondria
    c. Vacuole
    d. Cytoplasm
2. Why do plant cells have more of a rigid structure than animal cells?
    a. They have more ATP.
    b. They have a cell wall.
    c. They do not contain a cell membrane.
    d. They lack a cytoplasm.
3. Which structures are unique to plant cells?
    a. Mitochondria and chloroplasts
    b. Ribosomes and nuclei
    c. Cell wall and chloroplast
    d. Vacuole and Cytoskeleton
4. Which organelle has ribosomes attached to it?
    a. Smooth endoplasmic reticulum
    b. Rough endoplasmic reticulum
    c. Mitochondria
    d. Vacuole
5. What is the name of the pigment in plants that allows them to carry out photosynthesis?
    a. Chloroplast
    b. Chlorophyll
    c. Carrots
    d. Cytosol

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Name: _____
Date: _____
Class: _____
Lesson Objective / Title: _____

Claim	Evidence	Reasoning

Open Science Discussion Protocol

1. An open science discussion using evidence begins with the teacher asking the core, open-ended question from the lesson.
2. Upon asking the question, allow for one minute of silence to give students time to review their notes or CER leading up to the discussion.
3. You can choose to have a fishbowl, where half the class is in an inner circle actively participating in the discussion, while the other half of the class is listening and taking notes.
4. Students should be given at least 10 minutes to discuss their thoughts. The teacher should mediate and facilitate, making it clear that students should be aware of equity of voice, and only speak __ number of times depending on class size.

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5. As students become more familiar with the classroom discussions, less teacher interruptions will be needed.

Categories	Mastery 3	Proficient 2	Developing 1	Total Points
Speaking	Student participates multiple times, offering ideas that push the discussion in new directions. Student explains with clear, correct, and relevant points using knowledge of chemistry and supports their argument with evidence.	Student participates minimally. Some remarks are off topic, however the point is understood. Student knows the information but struggles to explain or reference evidence during the discussion.	Student is either overly quiet or makes redundant remarks that do not advance the discussion. Student uses some relevant information, but it is unclear or unrelated to the discussion.	_____ / 3
Preparedness	Student comes with a completed CER chart which has clear speaking points and thoughtfully constructed open-ended questions.	Student comes with a partially completed CER chart which has some speaking points and open-ended questions. Questions are written but they may not stimulate further discussion.	Student comes with a partially completed CER chart and has little relevant evidence that directly supports their argument. Either no questions or poor questions were written.	_____ / 3
Listening	Student listens attentively, takes sufficient notes and references points made by classmates when speaking.	Student listens, but may be occasionally off task and takes insufficient notes. Student rarely or never refers to	Student struggles to listen and take notes.	_____ / 3

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		points made by classmates.		
Total Points				_____ / 9