

THIS WEEK'S LESSON ACTIVITIES

INSTRUCTOR _____ DATE _____ CLASS _____
LEVEL _____ ABE Level E _____

Topic: Plant Intelligence
Guiding Question: Can plants think?

Lesson Objectives:

The students will:

- 1) Produce a persuasive essay using textual evidence to support their claim.
- 2) Compare and contrast multiple texts.
- 3) Use graphic organizers to take notes and organize evidence/main ideas.

CCR Standards Aligned to this Lesson:

RI/RL.9-10.1

RI/RL.11-12.2

RST.9-10.9

W/WHST.9-10.1

W/WHST.9-10.2

Reading: The instructor reads the entire text aloud to the students. The students then pair-read up to line 30. Students read through line 30 independently and with a pencil. Students underline any difficult terms or concepts, circle any words or phrases they feel are important, and note brief summaries in the margins (without using complete sentences). If students struggle with any vocabulary, encourage them to keep reading and use context clues to define the term. Vocabulary discussions should be held after the student struggles with the text for a while. Use Context Clues graphic organizer (scroll down) for vocabulary (link:) http://www.brighthubeducation.com/teaching-middle-school/78633-using-graphic-organizers-to-teach-vocabulary/#imgn_0 Distribute or post Accountable Language Stems (below) to help students participate in a deep, academic discussion about the text. Lead a class discussion on lines 1-30 using the text-dependent questions below. Discuss the three plant intelligence images found at the end of this lesson plan. What do you see in each of the images? What is the artist trying to say? What is the artist's point of view on plant intelligence? What makes you say that? How do these images inform the text that we just read? What is the mood of the images?

Adapted from Institute for Learning, 2003

Accountable Language Stems

Agreement

- "I agree with _____ because _____."
- "I like what _____ said because _____."
- "I agree with _____; but on the other hand, _____."

Disagreement

- "I disagree with _____ because _____."

- “I’m not sure I agree with what ____ said because ____.”
- “I can see that ____; however, I disagree with (or can’t see) ____.”

Clarifications

- “Could you please repeat that for me?”
- Paraphrase what you heard and ask, “Could you explain a bit more, please?”
- “I’m not sure I understood you when you said _____. Could you say more about that?”
- “What’s your evidence?”
- “How does that support our work/mission at _____?”

Confirmation

- “I think _____.”
- “I believe _____.”

Confusion

- “I don’t understand _____.”
- “I am confused about _____.”

Extension

- “I was thinking about what ____ said, and I was wondering what if _____.”
- “This makes me think _____.”
- “I want to know more about _____.”
- “Now I am wondering _____.”
- “Can you tell me more about _____?”

Review

- “I want to go back to what ____ said.”

****When asking text-based questions, ask students to cite the line (or point to the text) where they find the evidence.****

Text-Based Questions	Possible Answers
Who published this article? What can the reader infer about the author’s position on plant intelligence?	Animal Intelligence (.org) A website dedicated to animal intelligence will probably select articles based on evidence of animal and/or plant intelligence. (line 2)
Why did the author title his piece with a question?	(many answers) To build curiosity/interest in the article. To make the reader question her position on the matter. (line 3)
What fictional sources did the author cite? Why did he begin his text this way?	A Fire Upon the Deep, A Deepness in the Sky, and The Lord of the Rings. (many answers) (lines 5, 8, 10) Uses fiction to introduce the fantastic nature of possible plant intelligence. May have mentioned sci-fi to connect with the audience or to make his piece more relevant to the general public.
What is the meaning of the term, “hive	Refers to a beehive. Bees communicate

mind” in line 7?	with the queen without speaking. A type of collective consciousness.
What three examples does the author use to illustrate plant communication in paragraph 1? What is the author’s intention?	Canines operating like bees (line 7), trees speaking with fronds (line 7-8), and a race that resembles spiders (line 9). (many answers) Beguines the reader to ask the question, could some aspect of this plant/animal behavior be real? He wants to blur the line between reality and fiction.
Who are the Ents? Why did they talk slowly? Why did the author further illustrate his sci-fi point with a second paragraph?	Tree race in <i>The Lord of the Rings</i> . (line 10-11). They spoke slowly because they had plenty of time and wisdom to do so. (line 13) (many answers) To further illustrate the point of the possibility of intelligent plant life and to further blur the lines between reality and fiction. Used a pop-culture reference to relate to the reader.
Why does the author use the word, “real” in front of world in line 14?	He is transitioning from science fiction to reality and wants to make that point clear.
What is the definition of “credence” in line 14? What context clues helped you to define it?	Belief as to the truth of something. (dictionary.com) The author describes fiction, switches to the ‘real world’ and writes “few people”. We can extrapolate that few people believe that plants possess intelligence.
Why might ‘few people’ believe in plant intelligence?	(many answers) We can’t hear plants communicate, they don’t move (except to grow), it may be hard to believe that things without ‘brains’ can communicate.
Why would the notion of intelligent plant life “seem absurd”?	Because we don’t understand it yet.
The use of ‘yet’ suggests what?	A shift or contradiction in the current argument.
Based on the transition on line 15, what do you think Michael Pollan’s position is regarding plant intelligence?	He probably believes in plant intelligence. “Yet” followed absurd, which means the reader is about to see the opposite viewpoint (not absurd).
Why is “are” italicized in line 16?	To stress that plants “ARE” intelligent. It is not a matter of <i>IF</i> plants are smart, but <i>HOW</i> smart are they? Assumes that plants are intelligent, we just need to know on what scale.
What does Pollan discuss in his	Research on plant intelligence. (line 17)

recent article? What resources does he cite?	
What does the term, “proponent” mean on line 21? What textual clues help you to define it?	A person who argues in favor of something. (dictionary.com) The author discusses research on plant intelligence. We can assume the authors that Pollan cites support his viewpoint.
Summarize the quote on lines 22-27.	Plants exhibit behavior that cannot be explained by traditional science; there are ‘brainlike’ behaviors.
If certain plant behaviors cannot be explained by genetic and biochemical science, what can they be attributed to? Why would some people find this be difficult to believe?	A brainlike information-processing system. (line 26) Difficult to believe a plant without a traditional brain has a ‘brain’.
What does a plant ‘brain’ do?	Integrate data and coordinate a plant’s behavioral response. (line 26-27)
Why is it that “human arrogance” keeps us from believing in plant intelligence?	(many answers) We think we know everything about our world. Oftentimes we need to see to believe.
How does a plant’s ‘slower dimension of time’ keep us from ‘appreciating their intelligence?’ (line 29)	Human life is so fast-paced. We can see our children grow right in front of our eyes. We do not notice when a plant is feels its way to a supportive branch to help it grow upward. We don’t see a tree intentionally grow towards or away an object. We cannot see or hear plants communicate because it may take weeks or months of observation.
How does Pollan feel about plant intelligence?	Believes it is real and measurable.
How did the author organize the ideas in the article thus far?	Introduces a concept using science fiction, writes that it may seem absurd, and then presents an argument for plant intelligence (so far).
What type of text is this?	Informative. Possibly controversial.
How does your own point of view compare to Pollan’s? (State what Pollan believes and then your own opinion).	(many answers)
Identify the reasons/evidence the author gives to support his key points.	Cites an article in <i>The New Yorker</i> , a reputable periodical, to support plant intelligence. Cites Pollan’s discussion of current research and Chamovitz’s book. Uses the quote on line 22-26 to suggest plants have brains and uses the quote on

	lines 28-30 to support the plant-brain theory.
What is the author’s point of view on the topic? What makes you say that?	
The first word on line 31 is “Detractors”. What do you think the author will discuss next? Why?	The opposing viewpoint. He wants to present both sides of the argument.
<p>How I will scaffold my lessons to reach all of my students' levels: Multiple exposures to the text (read aloud, pair-read, independent read). Use of Accountable Talk stems to foster deep, academic discussion. Require students to locate answers in the text (they can share the location of a line with a neighbor if one is having trouble). Reading with a pencil – students have to actively interact with the text. Teacher can monitor notes on students’ text. Provide Context Clues graphic organizer.</p>	
<p>How I will assess my students' mastery of the lessons: Observing students notes on their reading texts. Listening to, and evaluating, responses to text-dependent questions. Evaluate student essay using rubric.</p>	
<p>My reflections of the lessons (what worked, what didn't, what I might change for next time):</p>	
<p>Resources: Mancuso, Stefano, <i>The Roots of Plant Intelligence</i>. Pearltrees. http://www.pearltrees.com/u/6484201-stefano-mancuso-intelligence Pollan, Michael, <i>Can Plants Think?</i> Science Friday, January 3, 2014. http://www.sciencefriday.com/segment/01/03/2014/can-plants-think.html Pollan, Michael. <i>Plant Neurobiology</i>. NewYorker.com, 2014. http://video.newyorker.com/watch/commentary-plant-neurobiology Roth, J.D., <i>Are Plants Intelligent?</i> Animal Intelligence, January 10, 2014. http://www.animalintelligence.org/</p>	
<p>Multi-Day Plan Day 1: See plan under “Reading” section above. Day 2: Repeat Day 1 using lines 31-55. Ask text-dependent questions on this section and the text as a whole. Watch the <i>Can Plants Think</i> video and ask students the questions on line 52. Day 3: Watch Stefano Mancuso’s TED Talk, <i>The Roots of Plant Intelligence</i>, on Pearltrees (13 min.) Distribute blank Cornell Notes (or have students use template to create one in their notebooks). Students take notes on the video. After the video, students (in groups of 3 or 4) share their Cornell Notes with their group. Have students discuss: what was the author’s point of view on the topic of plant intelligence? What were some of his reasons/evidence to support his claim? Compare this author’s view to Roth’s article from Day 1 and 2. How does</p>	

this video connect to what we have already read? How is it different? Summarize Mancuso's argument. What was the tone/mood of the video?

Day 4: OPTIONAL: listen to Pollan's NPR interview , *Plant Neurobiology* (23 minutes).

Repeat the activity with the Cornell Notes (Day 3). Ask text-dependent questions based on the audio clip. Students have now heard/read/viewed 3-4 texts on the subject. As a class, create a chart with 3-4 columns (depending on the number of texts) to represent the various texts. Fill the charts with authors, text titles, main ideas, points of view, etc.

Day 5-7: Distribute the GED RLA rubric for extended responses as well as the essay topic, *Can plants think?* Students need to create an argument to support their position using textual evidence to support their claim. Use the writing process. Include peer editing in addition to your own feedback on rough drafts. Use a textual graphic organizer like the one found here: <http://www.docstoc.com/docs/79150363/graphic-organizer-freshman-reg> to help organize ideas. Model how to use the organizer.

1

2 ANIMAL INTELLIGENCE

3 Are Plants Intelligent?

4 by J.D. Roth on 10 January 2014 · in PLANTS

5 In *A Fire Upon the Deep*, the 1992 science-fiction novel from Vernor Vinge, the action takes place in a
6 vast galaxy populated by a variety of interesting alien species. On one planet, there's a race of canines
7 that operate with hive minds. Elsewhere, there's a race of trees that can speak with fronds and which
8 move about on mechanical platforms. (The 1999 prequel *A Deepness in the Sky* features another
9 interesting race, one resembling spiders.)

10 Before that, J.R.R. Tolkien's *The Lord of the Rings* featured the Ents, a hyper-intelligent (and
11 powerful) race of tree-like beings that existed in a world that largely ignored (or was unaware of) them.
12 The Ents moved and talked *s-l-o-w-l-y*, but because their lives were long, they had amazing memories
13 and tons of wisdom.

14 In our real world, few people give credence to the idea that plants might possess intelligence. The
15 notion seems absurd. Yet a recent article in the *The New Yorker* by Michael Pollan has raised the
16 question: **How smart are plants?**

17 Pollan discusses past research into this question, including the best-selling (but flawed) 1973 book *The*
18 *Secret Life of Plants*. But he spends most of his time discussing current research into the subject of
19 plant intelligence. He interviews a number of scientists, including Daniel Chamovitz, author of *What a*
20 *Plant Knows*.

21 Proponents of plant intelligence argue that:

22 The sophisticated behaviors observed in plants cannot at present be completely explained by
23 familiar genetic and biochemical mechanisms. Plants are able to sense and optimally respond to
24 so many environmental variables—light, water, gravity, temperature, soil structure, nutrients,
25 toxins, microbes, herbivores, chemical signals from other plants—that there may exist some
26 brainlike information-processing system to integrate the data and coordinate a plant's
27 behavioral response.

28 Those who believe that plants are intelligent say that “it is only human arrogance, and the fact that the
29 lives of plants unfold in what amounts to a much slower dimension of time, that keep us from
30 appreciating their intelligence and consequent success.”

31 Detractors argue that those who believe plants are intelligent are anthropomorphizing (a charge still
32 leveled at many folks who believe animals are intelligent). Too, there’s debate over the definition of
33 “intelligence” — and the definitions of other words that describe how organisms interact with their
34 environment. According to Pollan, the debate isn’t over what plants do, but over how these actions
35 should be labelled and classified.

36 In many ways, plants are like an alien species. Though they account for 99% of the biomass on this
37 planet, their lives are strange to us:

- 38 • They’re *sessile*. That is, they’re permanently rooted to one spot.
- 39 • They’re modular. Humans (and most other animals) don’t have redundant parts. And if we lose certain
40 organs, we die. But a plant can lose up to 90% of its body without being killed.
- 41 • They have no central nervous system. They have no brain. We have a single organ dedicated to mental
42 processes. Plants seem to derive what intelligence they may have from the tips of their roots.
- 43 • When plants communicate, they do so with chemicals rather than motion or sound.
- 44 • As noted earlier, plants exist on a different time scale than we do. They move so slowly that their
45 actions seem imperceptible to us.
- 46 • Plants “eat” light.

47 In his article, Pollan describes research into plant behaviors that resemble what we might call
48 “learning” or “decision-making”. He discusses whether or not plants feel pain. He also talks about
49 communication and cooperation and, amazingly enough, simple plant “economies” in which different
50 species trade with each other.

51 Here’s a video clip that demonstrates some plant behavior that resembles intelligence: (WATCH
52 VIDEO – see link for *Can Plants Think?* in resources)

53 What do *you* think? Is it possible that plants are intelligent? If so, what are the implications?

54 I first explored the idea of plant intelligence at this site more than six years ago. If you’d like more on
55 this subject, Pollan did a follow-up interview on NPR’s “Science Friday”.

Context Clues Graphic Organizer

#1 Word in Sentence (underline word):

Word #1:

Original guess to meaning of word:	Part of Speech:	Definition:
	→	
+	+	+

#2 Word in Sentence (underline word):

Word #2:

Original guess to meaning of word:	Part of Speech:	Definition:
	→	

