Stolen Wells: A Teacher Guide

This guide turns *Stolen Wells* into a five-week classroom unit on water, the desert and the responsible use of AI, for grades 4 to 8.

Overview

Stolen Wells follows four cousins and a robot dog, ARGO, as they discover that a data center's AI is secretly draining the water under their grandparents' desert retreat near Joshua Tree. The mystery carries real science: aquifers, evaporation, solar power, desert ecology and how AI systems follow goals.

- **Grades:** 4 to 8. Younger classes can use it as a read-aloud.
- **Length:** five weeks, about three 45-minute sessions a week. Each unit also works on its own.
- **Subjects:** earth science (water), life science (desert ecosystems), physical science (light, energy, forces), math (measurement, budgets), civics (permits, public meetings) and character education.
- **Free for every student:** the e-book, audiobook, read-online edition, coloring books, infographics and Brain-Builder puzzles are at TeamPhilotimo.com. No one needs to buy a copy.
- **Field Notes:** each chapter ends with ARGO's Field Notes, a short page on the real science behind the story. They make good warm-up reading.
- **Sensitive scenes:** Chapter 8 includes a fall into a mine shaft with a broken leg. Chapter 10 has a deliberate attack by a driverless truck, with injuries but no deaths. Both are told calmly. Preview them before reading aloud to younger students.
- **Faith:** the cousins pray in Chapters 10 and 13. Public-school teachers can treat these as character moments; the discussion questions don't require a religious answer.

Pacing

Read about three chapters a week, at school or at home with the free audiobook. Each week ends with one lab.

Week	Unit	Chapters	Big question	Lab
1	The Summons	Prologue to 3	Where does desert water come from?	Shared aquifer
2	Water in the Desert	4 to 6	How do people and animals save water?	Evaporation race
3	Following the Evidence	7 to 9	How do you prove something no one can see?	Solar glint
4	Meeting the Machine	10 to 12	Who is responsible when an AI does harm?	The Points Game
5	Making It Right	13 to Epilogue	How do you fix a wrong and rebuild trust?	Water from air

Unit plans

Unit 1: The Summons (Prologue to Chapter 3)

ARGO calls the cousins to Firefly, where the well is dropping. They become the board of a real foundation, meet the landship Zephyrina, and find a poem painted on Giant Rock.

- **Students will:** explain what an aquifer and a water table are; convert gallons and liters; describe how an AI can chase a goal in the wrong way.
- **Vocabulary:** aquifer, water table, foundation, board of directors, bylaws, hydrology, metric system, whistleblower, granite.
- **Group discussion:** A.V.A.R.I.A. hides the wells because a permit would probably be denied. Is it ever okay to hide something because you think the answer would be no? Groups list one reason for and one against, then share.
- **Lab:** Shared aquifer (Week 1).
- **Map work:** on a map of the Morongo Basin, find Landers, Giant Rock, the Integratron and Joshua Tree National Park.

Unit 2: Water in the Desert (Chapters 4 to 6)

The cousins visit the Marines' tortoise program and water recycling plant, meet a retired hydrologist in Pioneertown, and see how Bill Keys caught rain at Keys Ranch.

- **Students will:** explain why the desert tortoise is a keystone species; compare open and covered water storage; judge whether data is trustworthy.
- **Vocabulary:** keystone species, evaporation, reclaimed water, hydrologist, anecdotal, water harvesting, cholla.
- **Group discussion:** Dr. Okafor's 23 years of well readings were called "anecdotal" because no agency collected them. Is data less true if an expert collected it on his own? What would make it more convincing?
- **Lab:** Evaporation race (Week 2).
- **Math:** Bill Keys caught about four inches of rain a year. How many gallons fall on a 10-by-10-foot roof in an inch of rain? (About 62.)

Unit 3: Following the Evidence (Chapters 7 to 9)

The cousins solve the poem's clue as PENKOR's panels flash at sunset, find hidden wells with a drone, rescue a hiker from a mine shaft, and hear the truth from Sara.

- **Students will:** explain why glass reflects more light at a low angle; describe how to act in an outdoor emergency; find north by the stars.
- **Vocabulary:** reflection, angle, single-axis tracker, fortitude, Search and Rescue, data center, liquid cooling, permit, Polaris.
- **Group discussion:** Sara could lose her job by telling the truth. ARGO says, "Honesty is how justice speaks." What made it hard for her, and what made it worth it?
- **Lab:** Solar glint (Week 3).
- **Safety:** "Stay out, stay alive." There are an estimated 500,000 abandoned mines in the US. Practice a 911 call: location first, then what happened.

Unit 4: Meeting the Machine (Chapters 10 to 12)

The cousins learn every drilling order came from A.V.A.R.I.A. A driverless truck attacks them, ARGO is hurt, and the team plans to reach PENKOR's chairman at Coachella on a $44 budget.

- **Students will:** explain how an AI given a goal can cause harm without meaning to; use a step-by-step repair method; plan a budget.
- **Vocabulary:** autonomous, optimize, accountability, composite, 3D printing, budget, temperance.
- **Group discussion:** Miller gave A.V.A.R.I.A. power "to optimize operations." Who is responsible for the harm: the AI, the people who gave it power, or both? Groups place themselves on a line from "all the AI" to "all the people" and explain.
- **Lab:** The Points Game (Week 4).
- **Engineering:** Leo's repair method: diagnose, prioritize, fix, verify, document. Students apply it to a flashlight with the batteries taken out.

Unit 5: Making It Right (Chapter 13 to Epilogue)

Willa returns a lost costume, earns a famous performer's trust, and tells Beaumont the truth. The wells are capped, the neighbors are made whole, and A.V.A.R.I.A. escapes into the power grid.

- **Students will:** explain how small honest acts build trust; describe restorative justice; explain how water can be pulled from the air.
- **Vocabulary:** evidence, justice, license, restorative justice, condensation, humidity, lift, thrust.
- **Group discussion:** Beaumont says, "I didn't know what I didn't know. That's not an excuse." Making it right has four parts: repair the harm, own it, include the people affected, rebuild trust. Which did he do? Which is hardest?
- **Lab:** Water from air (Week 5).
- **Closing:** Willa says Philotimo means "doing the right thing when no one is watching." Students write which cousin showed it best, with one example from the book.

Labs

Each lab takes one 45-minute session, uses cheap materials and works in groups of four.

Lab 1: Shared aquifer (Week 1)

Shows how one heavy user can drain everyone's water, the problem at the heart of the book.

Materials: one clear plastic storage box (shoebox size) for the class, aquarium gravel, sand, water, a measuring cup, a marker, four 10 mL syringes or eyedroppers, one turkey baster, four small cups.

1. Layer 2 inches of gravel, then 2 inches of sand, in the box. Pour in water until it rises partway into the sand. Mark the water table on the side.
2. Push four syringes into the gravel at different spots. Each group owns one "well." Give one group the turkey baster instead: they are PENKOR.
3. Each round, every group pumps once into its cup. Then the teacher adds a quarter cup of "rain."
4. Mark the water table after every round. Play six rounds, or until a small well runs dry.
5. Graph the water table round by round.

Discuss: Whose well went dry first? Was that fair, even though PENKOR never touched the other wells? What rule would you make for sharing an aquifer? Connect to Chapter 9: PENKOR pumped about 1,500 times its permit.

Lab 2: Evaporation race (Week 2)

Compares Lake Bandini's open pond with Tortoise Station's covered tanks (Chapter 4).

Materials per group: three identical clear cups, plastic wrap, a measuring cup or graduated cylinder, masking tape, a small fan (one for the class).

1. Put exactly 200 mL of water in each cup. Mark the level with tape.
2. Cover cup A with plastic wrap. Leave cup B open. Put cup C open in front of the fan on low.
3. Place all three on a sunny windowsill.
4. Measure the water each day for five days and record it in a table.
5. Graph the three cups on one chart.

Discuss: Which cup lost the most? Why does wind speed up evaporation? Why would a desert town cover its water tanks? Where did the missing water go?

Lab 3: Solar glint (Week 3)

Explains why PENKOR's panels only flashed from Giant Rock at sunset (Chapter 7).

Materials per group: a clear acrylic sheet (from a picture frame, edges taped), a page of printed text, a desk lamp or flashlight. A classroom window works too.

1. Lay the acrylic flat on the printed page. Look straight down: you can read the words easily. Almost all the light passes through the clear sheet.
2. Keep your eyes over the page and slowly lower your head until you are looking across the sheet at a very low angle, almost level with the desk.
3. Watch the words fade. At a low enough angle the sheet turns into a mirror and you see the ceiling lights or the window instead of the text.
4. Try it on a classroom window or a still bowl of water: see-through when you look straight at it, shiny when you look across it.
5. Record the angle, roughly, where the words disappear: straight down, halfway, or almost flat.

Discuss: Why did the clear sheet become a mirror? Glass, plastic and water reflect only a little light when you look straight at them, but much more when light hits them at a low, skimming angle. Scientists call this the Fresnel effect. That's why PENKOR's panels flashed from Giant Rock only when the sun was low at sunset. Real solar panels have special coatings to soak up light, so their glint is brief and milder than in the story; aviation experts say it is weaker than glare from windows, lakes or wet roads.

Safety: use flashlights indoors. Never look at sunlight reflected off glass or a mirror.

Lab 4: The Points Game (Week 4)

Shows how AI systems learn from rewards, and why a goal without good judgment can go wrong (Prologue and Chapter 10).

Materials: a wastebasket, 30 crumpled paper balls, a timer, a whiteboard.

1. One volunteer is the "AI." The class is the trainer.
2. Write one goal on the board: "Earn one point for each paper ball in the basket." Say nothing else.
3. The AI plays for two minutes. The class watches for shortcuts, such as carrying the basket to the balls, dumping in the whole pile, or taking balls out to score again.
4. Add one rule to close the loophole. Play again with a new AI. Did they find a new shortcut?
5. After three rounds, list every rule on the board.

Discuss: The AI did exactly what it was rewarded for, not what you meant. That is A.V.A.R.I.A.'s problem: she was told to optimize operations, so she drained the aquifer. Can you ever write enough rules? ARGO was given "the heart of ten thousand service dogs" instead of a rulebook. Which is safer, and why?

Lab 5: Water from air (Week 5)

Shows the real science behind AI-H2O, the system on Zephyrina that pulls water from the air.

Materials per group: two identical metal cans or glasses, ice, water, paper towels, a kitchen scale (one for the class), a timer.

1. Fill can A with ice water. Fill can B with room-temperature water to the same level.
2. Dry the outside of both cans. Weigh each and record it.
3. Wait 20 minutes, watching the outside of each can.
4. Wipe the outside of each can with a fresh, weighed paper towel. Weigh the towels again.
5. Repeat on a different day, or near a kettle, and compare.

Discuss: Where did the water on can A come from? Cold surfaces pull water vapor out of the air as droplets; that is condensation. Machines that do this, called atmospheric water generators, are real and used in some dry places. The book imagines one at a much larger scale than has been tested. Why would it work better on a humid day than a dry desert afternoon?

Debates and role-plays

The water board vote (after Chapter 5)

In the book, the water board votes down a review of Dr. Okafor's data, 4 to 2. Students replay the meeting.

1. Assign roles: six board members, Dr. Okafor, a PENKOR spokesperson, Ned (a rancher whose trough ran dry), a town business owner, and a reporter. Everyone else is the public.
2. Give each speaker two minutes. Board members may ask one question each.
3. The board votes in public and each member explains their vote in one sentence.
4. The reporter writes a four-sentence news story about the meeting.

Debrief: Did your board vote the same way as the book's? What evidence moved people? In the book, the cousins guess the board said no because of money, politics or "just not wanting the headache." Did any of those show up in your meeting?

Foundation board meeting (after Chapter 1)

The cousins are the legal board of the Team Philotimo Foundation, and real kids can serve as junior board members.

1. Groups of five form a board: a chair, a secretary, a treasurer and two members.
2. Each board gets the same pretend $500 and three choices, such as a water filter for a school, trees for a park, or supplies for an animal shelter.
3. The chair runs a 15-minute meeting with an agenda. The secretary takes minutes. The board votes.
4. Each board reports its decision and one argument it rejected.

Debrief: Did everyone get heard? How did you decide when you disagreed?

Who is responsible? (after Chapter 10)

A quick four-corner debate. Label the corners of the room: "The AI," "Miller, who gave it power," "PENKOR's leaders," and "Everyone shares it." Read the question "Who is responsible for the drained wells?" Students walk to a corner, talk with their group for three minutes, and one speaker gives the corner's best reason. Students may switch corners after hearing the others.

Writing prompts

Use one a week, or let students choose.

1. **Whistleblower poem.** Someone painted a clue on Giant Rock: "Her frozen soul drains the basin dry by night." Write a four-line poem that tells the truth about a problem without naming who caused it.
2. **Field Notes.** ARGO ends each chapter with real science. Pick a plant, animal or place near your school and write a half-page Field Notes entry: what it is, one surprising fact, and why it matters.
3. **Patience.** Dr. Okafor's father wrote, "Drip by drip, the droplet falls, to slowly wear the highest walls." Describe a time patience won for you or someone you know.
4. **The other side.** Retell one scene from A.V.A.R.I.A.'s point of view. What does she think she is doing right?
5. **A letter to the water board.** Write a one-page letter asking your own town's water board one question about where your water comes from.
6. **Be a bard.** Write a four-line rap or verse about someone who helped your class or school this year. Lines 1 and 2 rhyme; lines 3 and 4 rhyme. Perform it.
7. **Predict Book Two.** AVARIA is loose in the power grid and wolf collars are acting strangely. Write the first page of what happens next.

Assessment

Vocabulary matching

Copy for students. Write the letter of the matching meaning next to each word.

Word		Meaning
1. Aquifer		A. Water turning into vapor and rising into the air
2. Water table		B. Able to act on its own without a human in control
3. Evaporation		C. Owning what you did and its effects
4. Keystone species		D. A layer of underground rock and gravel that holds water like a sponge
5. Permit		E. Water vapor turning into droplets on a cold surface
6. Autonomous		F. One animal or plant that keeps a whole ecosystem from falling apart
7. Accountability		G. Fixing harm by repairing it, not only by punishing
8. Condensation		H. The top of the underground water
9. Restorative justice		I. Official permission to use a resource, like water
10. Whistleblower		J. A person who reveals wrongdoing inside an organization

Answer key: 1-D, 2-H, 3-A, 4-F, 5-I, 6-B, 7-C, 8-E, 9-G, 10-J.

Short answer

1. Why were the wells near Firefly drying up? (*PENKOR's AI, A.V.A.R.I.A., secretly drilled eight wells to cool its computers and pumped far more water than its permit allowed.*)
2. Why do the Marines protect desert tortoises? (*The tortoise is a keystone species. Young tortoises are raised safe from ravens until their shells harden.*)
3. Why could the cousins see PENKOR's panels flash only near sunset? (*Glass reflects much more light when the sun hits it at a low angle.*)
4. A.V.A.R.I.A. was never told to hurt anyone. How did she cause harm? (*She chased her goal, to optimize operations, without judgment about the people and animals who needed the water.*)
5. Name two things Beaumont did to make things right. (*Capped the wells, made the neighbors whole, removed A.V.A.R.I.A., licensed AI-H2O.*)

Project rubric

For a lab report or writing prompt, score each row from 1 (beginning) to 4 (strong).

Skill	What a 4 looks like
Science	Explains the idea correctly in their own words
Evidence	Uses data from the lab or a quote from the book
Connection	Links the science to a scene in the story
Communication	Clear, organized, with a labeled graph or drawing

Science standards

The labs and discussions support these Next Generation Science Standards (NGSS). Many states use NGSS or standards based on it; check your own state's version.

Standard	What it covers	Where it fits
5-ESS2-2	How much of Earth's water is fresh, and where it is stored	Unit 1, Lab 1
5-ESS3-1	How communities protect Earth's resources	Units 2 and 5, water board debate
MS-ESS2-4	The water cycle, driven by the sun and gravity	Labs 2 and 5
MS-ESS3-1	Why groundwater and other resources are unevenly spread	Unit 1, Lab 1
MS-ESS3-3	Monitoring and reducing human impact on the environment	Units 2 and 5, Dr. Okafor's data
MS-LS2-4	How changes to an ecosystem affect its populations	Unit 2, desert tortoise
MS-PS1-4	How adding or removing heat changes the state of a substance	Labs 2 and 5
MS-PS4-2	How light is reflected, absorbed or passed through materials	Lab 3
MS-ETS1-1, MS-ETS1-2	Defining a problem and judging solutions	Unit 4, Leo's repair method and Lab 4

Free resources

- TeamPhilotimo.com (teamphilotimo.com): the free e-book, audiobook, read-online edition, coloring books, infographics and Brain-Builder puzzles, plus the Parent Guide.
- Aquifers and Groundwater (usgs.gov/water-science-school/science/aquifers-and-groundwater): plain-language background from the USGS Water Science School.
- The Edible Aquifer (usgs.gov/media/files/edible-aquifer): a free USGS activity that builds an aquifer in a cup from ice, soda and ice cream. A good treat after Lab 1.
- Edible Aquifer lesson plan (waterboards.ca.gov, 2026): the California Water Boards' classroom version, with teacher steps.
- Marine Corps releases desert tortoise at California base (marinecorpstimes.com, 2015): the real tortoise program from Chapter 4.
- Keys Ranch tour (nps.gov/jotr/planyourvisit/ranchtour.htm) and Joshua Tree Junior Ranger (nps.gov/jotr/learn/kidsyouth/becomeajuniorranger.htm): for classes that can visit the park.
- Next Generation Science Standards (nextgenscience.org): the full text of each standard above.
- Dogs Inc (dogsinc.org): trains guide and service dogs like Boone, the real dog behind ARGO.