mytekDev

Light Show Lab: Fix-It Houses

Grades 7-9 · 45 minutes

Computer science · Engineering



Slides, rubric and answer key **Print and go** **No student accounts**

Chromebook friendly

What's included

- A one-page overview: objectives, essential question, vocabulary, standards and assessment
- A 45-minute lesson sequence: warm-up, direct instruction, guided practice, independent practice, closure
- Slides for the board: a PowerPoint file that also opens in Google Slides
- A student worksheet with a QR code and a fault log
- A 3-question exit ticket, two to a page, with an answer key
- A rubric: 3 criteria, 4 levels, scored out of 12
- Differentiation for English learners, students with IEPs or 504 plans, and students who need more support or more challenge
- Cross-curricular extensions, and notes for teaching it in grade 6 and in grades 10 to 12
- Standards: CSTA 2017

Light Show Lab: Fix-It Houses

Grades 7-9 · 45 minutes · Computer science, Engineering

Six houses, each with one thing wrong in the box that runs its lights. Students start with the easiest: every red on the house shows as green, because the controller sends its three numbers in the order green, red, blue and the pixels read red, green, blue. Then a port goes dark at bar 3: its fuse is 5 amps and the show asks it for 6. For each house they record the symptom, what they checked, the cause and the fix, in that order, and learn to check power, then data, then settings. The app says Fixed when the box would run the whole show.

At a glance

ESSENTIAL QUESTION

When something is wrong with a system, how do you find the one thing that is wrong?

OBJECTIVES

Students will be able to:

- describe a fault by its symptom before guessing at its cause
- check a system in a fixed order, power, then data, then settings, and record each check
- explain how a color is sent as three numbers, and what happens when the order of the numbers is wrong
- fix at least three faults and say why each fix worked

VOCABULARY

Symptom, Cause, Fuse, Amp, RGB

STANDARDS

2-CS-03, 1B-CS-03, 2-DA-07

TIME AND MATERIALS

45 minutes, grades 7-9.

- One computer or Chromebook per student
- A projector
- The worksheet and exit ticket, one copy each per student
- The rubric, one copy per student if you grade the work

PREP

Make copies of the worksheet and exit ticket. Before class, open mytekdev.com/try/lightshowlab?lesson=fix-it-houses&ref=tpt-lightshowlab-4 once on a student computer: it opens on a working house with the Box at the Real level, and checks that your school's filter allows the app. Follow the short guide yourself, about six minutes: it fixes two of the six houses. Read the answer table in Before you teach for the other four.

ASSESSMENT

- Formative: the questions under What to look for, asked while students work, and the exit ticket (answer key included).
- Summative: the worksheet, scored with the rubric.

TECHNOLOGY AND PRIVACY

Runs in any browser, Chromebooks included, with nothing to install. Students need no account and no email: the link works signed out, and nothing they do is stored on our server unless they choose to save. The music is played by the page, so headphones help, and the Sound button turns it off.

Lesson sequence

MINUTES	STAGE	WHAT YOU DO	WHAT STUDENTS DO
0 to 5	**Warm-up** Hook	Show the title, essential question and Today I can slides (about 1 minute). Then the warm-up: half the lights go dark in the middle of the show. List everything that could be wrong, on the board.	List three possible causes on the worksheet.
5 to 12	**Direct instruction (I do)** Model it	Show Symptom first, then check in order. Project the app, open Box, and press Red and green are swapped. Ask for the symptom in plain words before anything else: the porch posts are green and white. Tap a green bulb and read the line under the Addresses table aloud. Show Red sent, green shown, then press RGB: the status reads Fixed. **It's working when:** Refuse the first guess at a cause until someone has said the symptom. It is the habit the whole lesson is for.	Watch, and fill in the vocabulary and the first row of the fault log.
12 to 20	**Guided practice (We do)** Two houses	Students open the link or scan the QR code. A short guide walks them through the swapped colors and then A port goes dark. For the second one they read the status box: port 4, bar 3, 6.0 amps asked of a 5 amp fuse. Check that every screen reads Fixed. **Watch for:** Students who fix the fuse by trying buttons until the box says Fixed. Ask them which of the three suggestions in the status box they used, and why it lowered the amps on that port.	Fix both houses and log the second one: symptom, checks, cause, fix.
20 to 38	**Independent practice (You do)** Four more	Students work through the other four houses in any order, logging each. Three fixed, with a cause written for each, meets the objective. Walk the room with the What to look for questions. **If they ask:** "What did you check first on this one? Was it fine? What did that rule out?" The order **Watch for:** The dim house and the orange tree are faint on some screens. The status box names what the house shows, so let students read it when they cannot see it.	Diagnose, fix and log at least three houses in all.
38 to 45	**Closure** Showcase and exit ticket	Show the Showcase slide. Two students tell the story of their hardest house, including a check that found nothing. A check that finds nothing still rules something out. Hand out the exit ticket.	Answer the exit ticket.

Before you teach: a ten-minute walkthrough

Open mytekdev.com/try/lightshowlab?lesson=fix-it-houses&ref=tpt-lightshowlab-4. A short guide opens over the app. The house works, and the Box tab is at the Real level, which shows amps on every port, a power meter, an

Addresses table and, at the bottom, six fix-it houses. Each one replaces the house with the first house and one fault. `Back to my own house` returns to the working box.

FIX-IT HOUSE	WHAT STUDENTS SEE	THE CAUSE	A FIX
The chase runs the wrong way	In the chorus, from bar 19, the roofline chase runs toward the peak	The roofline is fed from its far end	Click Roofline 61, then Feed the other end
The tree turns orange	From bar 19, part of the tree is orange or pink when it should be white	One injection wire is not enough: the voltage sags in the middle of 600 pixels	Click Tree 600, then Add an injection wire
Red and green are swapped	The porch posts are green and white	The controller sends GRB to pixels that read RGB	Press RGB
A port goes dark	The porch lights go dark at bar 3 and stay dark	Port 4 is asked for 6.0 amps and its fuse is 5; the brightness is 60 percent	Click Porch 262, then Add an injection wire; or turn the brightness down to 30
The whole house is dim	Most of the show is dim	The show wants 526 watts at its brightest and one supply gives 348; the brightness is 75 percent	Add a power supply; or turn the brightness down to 30
Most of the bushes stay dark	The far two thirds of the bushes never light	Port 5 has 900 pixels and has time for about 700 at 40 frames a second	Press 20; or unplug Bushes 300 and plug it into port 6

1. **Read a bulb.** At the Real level, tap any bulb on the house. A line under the Addresses table gives its port, its pixel number, its channels and the three numbers the controller is sending it, and says why the bulb shows something else if it does.
2. **The status box.** It lists everything wrong with the box, in words, with numbers: which port, which bar, how many amps or volts. A house reads "Fixed" only when nothing is left on that list.

> The orange tree and the dim house are faint on some screens. The status box says what the house shows, so students can work from it. The volts and amps come from a simple model with typical numbers; How it works in the app says what it leaves out.

Background for the teacher

Troubleshooting is a method, not a talent. Start from the symptom, what can be seen. Check in a fixed order so that nothing is skipped, and write down the checks that find nothing, because each one rules something out. For a light show the usual order is power, then data, then settings.

Power. Every pixel draws current, and more when it is brighter. Each port has a 5 amp fuse that cuts off when the show asks for more. A long chain also loses voltage along its wire, so the far pixels get less than they need: blue and green fade first and white turns pink, then orange. An injection wire brings power in further along the chain, which fixes both. A power supply has a limit in watts, and an overloaded one shuts off and tries again.

Data. The controller sends a color for every pixel down the chain, a fixed number of times a second. A run fed from its far end plays its chase backwards. A port has only so much time before the next frame: about 700 pixels at 40 frames a second, about 1,024 at 20.

Settings. A color is three numbers, each 0 to 255, for red, green and blue. Pixels are made that expect them in different orders. If the controller sends green first to a pixel that expects red first, every red becomes green. Nothing is broken: two parts disagree about what the numbers mean, which is a common kind of fault in every computing system.

What to look for

Ask these while students work. A student who has understood the lesson can answer them without help:

- What is the symptom, in one sentence, with no guess in it?
- What did you check first? What did that rule out?
- The controller sends red 255, green 0, blue 0 and the bulb is green. Is the controller wrong?
- Why does adding an injection wire stop a fuse from tripping?
- Two fixes work for this house. Which would you pick, and what does it cost you?

> The third question is the test for the idea of encoding: the numbers are right and the order is wrong, so neither part is broken. They disagree.

Cross-curricular extensions

- Math: a port has a 5 amp fuse at 12 volts. Volts times amps is watts. How many watts can one port deliver?
- Science: find out why a thin wire gets warm when too much current runs through it, and what a fuse does about it.
- Writing: turn one row of your fault log into a help page: "If you see this, check these things in this order."
- Careers: ask someone who fixes cars, computers or networks what they check first, and why.

Vocabulary

Symptom	What you can see is wrong: part of the house is dark, a color is off.
Cause	The one thing that makes the symptom happen.
Fuse	A part that cuts the power when too much current is asked for, to protect the wire. Each port here has one, 5 amps.
Amp	A measure of electric current: how much electricity flows through a wire.
RGB	Red, green, blue: the three numbers, each 0 to 255, that set a pixel's color. Some controllers and pixels use another order, such as GRB.

Differentiation

ENGLISH LEARNERS

- Keep the vocabulary slide up, and point at the house on the board as you say each word: the lights carry the meaning.
- Give the fault log with the four column words translated or illustrated: symptom, check, cause, fix.
- Accept a symptom as a drawing of the house with the faulty part circled.

STUDENTS WITH IEPS OR 504 PLANS

- Pair students, one working the app and one keeping the log.
- Turn on Big screen for the house, or zoom the browser to 150%; the status box reads the fault in words for students who cannot see a faint color change.
- Allow two houses in all where the IEP allows a modified assignment.

STUDENTS WHO NEED MORE SUPPORT

- A sentence starter: "I saw ___. I checked ___. The cause was ___."
- Start with the chase that runs the wrong way and the swapped colors: both are one click to fix.
- Keep Symptom first, then check in order on the board for the whole lesson.

STUDENTS READY FOR MORE

- Fix A port goes dark a second way. Which fix would you choose for a real house, and why?
- Most of the bushes stay dark has two different fixes. Find both and say what each one costs you.
- Go back to your own house, break the box in a way no fix-it house does, and write the symptom for a classmate to diagnose.

Adapting for other grades

Younger students: In grade 6, do the two guided houses and The chase runs the wrong way, and leave the amps and volts as words the status box uses. Score the first two rubric rows, total 8, and 6 meets the objectives.

Older students: In grades 10 to 12, add the arithmetic: power is volts times amps, so a port at 12 volts and 5 amps can deliver 60 watts. Have students work out from the status box how far over each tripped port is, and write a one-page troubleshooting guide another student could follow.

Student worksheet

Name: _____ Date: _____

Open the app: scan the QR code, or go to mytekdev.com/try/lightshowlab?lesson=fix-it-houses

Essential question: When something is wrong with a system, how do you find the one thing that is wrong?

Warm-up: Half the lights on a house go dark in the middle of the show. Three things that could be wrong: _____

1. **Vocabulary.** Symptom, cause, fuse, amp, RGB: write each in your own words.

2. **The order.** I check _____ first, then _____, then _____.
3. **Fault log, house 1.** House: Red and green are swapped. Symptom: _____ What I checked: _____ Cause: _____ Fix: _____
4. **Fault log, house 2.** House: A port goes dark. Symptom: _____ Port _____, bar _____, _____ amps asked of a _____ amp fuse. Cause: _____ Fix: _____
5. **Fault log, houses 3 and 4.** For each: House, symptom, what I checked, cause, fix.

1. Name one thing you checked that turned out to be fine. What did that tell you?

2. The controller sent the right numbers and the bulb still showed the wrong color. How can both be true?

Exit ticket

Name: _____

1. Part of a house goes dark during the show. What do you do first? (A) add a power supply (B) write down exactly what you see, and when (C) start over

2. A controller sends red 255, green 0, blue 0. The bulb shows bright green. The most likely cause: (A) a tripped fuse (B) the color order is set wrong (C) the bulb is unplugged

3. A port's fuse trips when the show gets bright. Write one sentence naming a fix and why it works.

Light Show Lab: Fix-It Houses

Exit ticket

Name: _____

1. Part of a house goes dark during the show. What do you do first? (A) add a power supply (B) write down exactly what you see, and when (C) start over

2. A controller sends red 255, green 0, blue 0. The bulb shows bright green. The most likely cause: (A) a tripped fuse (B) the color order is set wrong (C) the bulb is unplugged

3. A port's fuse trips when the show gets bright. Write one sentence naming a fix and why it works.

Answer key: exit ticket

QUESTION	ANSWER	WHY
1	B	The symptom comes first. A fix made before the fault is understood can hide it or add a second one.
2	B	The bulb is lit, so it has power and data. It is reading the first number as green: the order is wrong.
3	Open answer	A full answer names a fix that lowers the current through the port: an injection wire shares the load, lower brightness draws less, fewer pixels on the port draw less.

Rubric

Score each row from 1 to 4.

Name: _____

CRITERIA	4 EXCEEDS	3 MEETS	2 APPROACHING	1 BEGINNING
Symptoms	Every logged house has a symptom written in plain words before any cause, with the bar or the part of the house named.	Every logged house has a symptom written before its cause.	Symptoms and causes are mixed together.	No symptoms logged.
A method	Checks in a stated order, records checks that found nothing, and says what each ruled out.	Checks in a stated order and records each check.	Records only the check that found the fault.	No checks recorded.
Cause and fix	Three or more houses fixed, each with its cause and a reason the fix worked.	Three houses fixed, each with its cause.	One or two houses fixed, or fixes with no cause given.	No house fixed.

Total: ____ / 12. A score of 9 or more meets the objectives.

Standards

The lesson is built for systematic troubleshooting, CSTA 2-CS-03, with 1B-CS-03 beneath it and 2-DA-07 for the color order fault.

FRAMEWORK	CODE	GRADES	STANDARD	HOW THE LESSON MEETS IT
CSTA 2017	**2-CS-03**	6-8	Systematically identify and fix problems with computing devices and their components.	Students find one fault in each of several control boxes by checking power, then data, then settings, and keep a log of every check.
CSTA 2017	**1B-CS-03**	3-5	Determine potential solutions to solve simple hardware and software problems using common troubleshooting strategies.	Each fix-it house is a simple hardware or software problem with a standard fix: a wrong color order, a run fed from the wrong end, a tripped fuse.
CSTA 2017	**2-DA-07**	6-8	Represent data using multiple encoding schemes.	A color is sent as three numbers, 0 to 255. Students see the same numbers read in two orders, RGB and GRB, and explain why red shows as green.

Checked November 2026 against: CSTA K-12 Computer Science Standards, Revised 2017.

Optional: save student work in a free class

The whole lesson runs at the link on the worksheet, with no accounts and no sign-up.

To keep students' work, and see it all in one place, make a free class. It takes about ten minutes, once, and covers every lesson in this series: mytekdev.com/tools/class-setup

Students in a class open mytekdev.com/tools/light-show-lab/lessons/fix-it-houses/start instead of the worksheet link. Each one gets their own copy of the starter, and the same link reopens it next time.

Terms of use

Thank you for downloading this lesson. The plan, the handouts and the art were made by mytekDev.

You may:

- print and copy it for your students
- change it for your own classes
- post it on your class website or learning management system
- share this file with other teachers, whole and unchanged, with this page included

You may not:

- sell it, or put it in a product you sell
- share a changed copy
- claim it as your own

The app this lesson uses is free and runs in the browser. Students need no account. It is at mytekdev.com.

Questions, or found a mistake? Ask on the Teachers Pay Teachers Q&A for this resource, or write to us at mytekdev.com/contact.

© 2026 mytekDev. All rights reserved.