Family edition

Keyboard Builder: Find What Broke

Ages 12-16 · about 45 minutes, in one sitting

Your child repairs three broken keyboards by testing first and replacing only the part that is wrong.

What you need

- A computer or Chromebook with a current browser, and a mouse or trackpad.
- The lesson link: mytekdev.com/try/keyboardbuilder?lesson=find-the-dead-key&ref=fam-keyboardbuilder-3. No account, no email and nothing to install.

Before you start: try it once yourself

Open mytekdev.com/try/keyboardbuilder?lesson=find-the-dead-key&ref=fam-keyboardbuilder-3. A short guide opens over the app. A customer's board is on the bench, and its diodes are on. Open the Matrix bench. Under the card is a box named Repair the customer's board, with three buttons that stay gray until a key has been clicked.

1. **One dead key.** Click G and J: both light. Click H. It does not light, and the box reads "Last key touched: H (row 3, column 7)". A repair is made on that key, the last one pressed down. Press Swap its switch. The order closes: "It was the switch under H. On a real board, look for a bent pin before buying a new switch."
2. **A wrong repair.** If you press Redo its row line with H last touched, the customer says "You redid the row line. The other keys in that row were working, so the line was fine." If you repair a key that works: "That key was working. Find one that does not light."
3. **A dead column.** Take the order A column of keys died at once. Click R and Y: they light. T, 5, G and B do not. With any of those four pressed last, press Redo its column line. The order closes: "It was the column line. Every dead key was on it, and the keys beside them were fine." Swapping one switch here draws "A new switch, and it still does not light. One switch cannot stop a whole column."
4. **7 types 8.** Take the order I press 7 and get 8. The app moves to the Keymap bench. Click the 7 key: the line under the board reads "7 on layer 0 sends 8." Click 7 under Numbers. The order closes: "Nothing was broken: the keymap had been changed."

> The moment that lands is the third board. Children who have just replaced two parts go looking for a third, and there is none.

The ideas, in plain words

Troubleshooting is the same on a keyboard as on anything else: find out what works, find out what does not, and ask what the failures share. A keyboard makes the sharing easy to see, because its keys are wired in rows and columns. One dead key whose row neighbors and column neighbors all work can only be its own switch. Several dead keys in a line share a wire. A key that works but sends the wrong thing is not a hardware fault at all.

On a real board that can be opened, a dead switch is often a bent pin that missed its socket, and reseating it costs nothing. A dead column is usually a broken solder joint or a cracked trace on the circuit board, and is a harder repair than the app's single button suggests. A key that sends the wrong character is most often a changed keymap on a programmable keyboard, or the computer's keyboard layout setting.

The app counts each wrong repair as a part replaced for nothing and has the customer say why it did not help. Those lines are worth reading aloud: each one names the test the child skipped.

Do it together

1. Open mytekdev.com/try/keyboardbuilder?lesson=find-the-dead-key&ref=fam-keyboardbuilder-3 together. A short guide opens over the app. Read what the customer says, open the `Matrix` bench, then click `G`, `J` and `H` on the board, in that order.

   > **You'll know it worked when:** `G` and `J` light. `H` does not.

2. Press `Swap its switch`.

   > **If you get stuck:** A repair is made on the last key pressed. If the box does not name H, press `Let go of every key` and click `H`.
   >
   > **You'll know it worked when:** The order closes: it was the switch under H.

3. Take the order `A column of keys died at once`. Click `R` and `Y`, then `T`, `5`, `G` and `B`.

   > **You'll know it worked when:** The four in a line are dead, and the keys on both sides work.

4. With a dead key pressed last, press `Redo its column line`.

   > **You'll know it worked when:** The order closes: every dead key was on that one line.

5. Take the order `I press 7 and get 8`. Click the `7` key on the board and read what it sends. Then click `7` under `Numbers`.

   > **You'll know it worked when:** The order closes. Nothing was broken: the keymap had been changed.

6. Ask: what would you check first on a real keyboard that types the wrong thing?

   > **You'll know it worked when:** Whether one key or many are wrong, and whether a setting was changed, before buying any part.

Talk about it

Ask these while you work together. A child who has understood it can answer them without help:

- Which keys did you test before you repaired anything, and why those?
- G and J worked. What did that rule out?
- What do T, 5, G and B share that R and Y do not?
- How did you know the 7 key's switch was fine?
- Which of the three faults would cost nothing to fix on a real keyboard?

> The second question is the real test: a child who says the row line must be fine, because other keys on it work, is reasoning from evidence.

For younger and older kids

Younger: For a younger child, do the first two repairs and ask them to point at what the dead keys share.

Older: For an older teen, ask them to write a one-page guide for fixing a keyboard: what to ask, what to test, and in what order.

Keep going

- On purpose, try the wrong repair first on a fresh copy of the lesson and collect what the customer says each time. What does each line teach?
- Set the level to High school and explain why one broken column line stops four keys but one broken switch stops one.
- Write a fourth repair order for someone else to solve: the symptom the customer would report, and the pattern a tester would see.

Bring it into other subjects

- English: write the message you would send the third customer, explaining what was wrong and why no part was needed.
- Science: a doctor also goes from symptoms to a cause. Write two ways fixing a keyboard is like that, and one way it is not.
- Careers: find out what a help desk technician does in a day, and which of today's steps they would use.
- At home: with an adult, find a device that is not working well and list three things you could test before replacing anything.

For your records

Ready to copy into an hour log, a portfolio or a transcript.

LESSON	Keyboard Builder: Find What Broke
SUBJECTS	Computer science, Technology
TIME	45 minutes
WHAT WE DID	Diagnosed three faults in a keyboard simulation by testing keys and reading the pattern, repaired each, and wrote troubleshooting steps.
SKILLS PRACTICED	Troubleshooting; Testing before repairing; Hardware and settings faults

Activity sheet (optional)

Name: _____ Date: _____

Open the app: scan the QR code, or go to mytekdev.com/try/keyboardbuilder?lesson=find-the-dead-key

Essential question: How can you tell what is broken before you replace anything?

Warm-up: A friend says "my keyboard is broken". What would you ask or try first? _____

1. **Vocabulary.** Symptom, fault, switch, column line, keymap: write each in your own words.

2. **The repair log.** For each board write: what the customer said, which keys you tested, what the dead keys shared, and the repair you chose. If the customer said a repair was wrong, copy what they said.

3. **Your steps.** Write three troubleshooting steps a friend could follow for any keyboard.

1. One key is dead and every key around it works. What is broken, and how do you know it is not a wire?

2. The third keyboard had no broken part. What was wrong, and where did you find it?

Quick check

Name: _____

1. Before replacing a part, a good troubleshooter first (A) buys a new keyboard (B) tests what works and what does not (C) replaces the cheapest part

2. Four keys in one column stop working on the same day. The most likely fault is (A) four bad switches (B) the wire those keys share (C) the keymap

3. A key works but types the wrong character. Name one thing to check that is not a broken part.

Answers

QUESTION	ANSWER	WHY
1	B	Testing shows which parts are fine, so only the part that is wrong gets replaced.
2	B	The keys share one column line. Four switches failing together is far less likely than one wire.
3	The keymap or the computer's layout setting	The switch closes and a code is sent, so the fault is in what the key is set to send or how the computer reads it.

If your state or umbrella school asks, this lesson covers CSTA 2017 2-CS-03, CSTA 2017 3A-CS-03.

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The app this lesson uses is free and runs in the browser, with nothing to install and no account needed. It is at mytekdev.com.

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