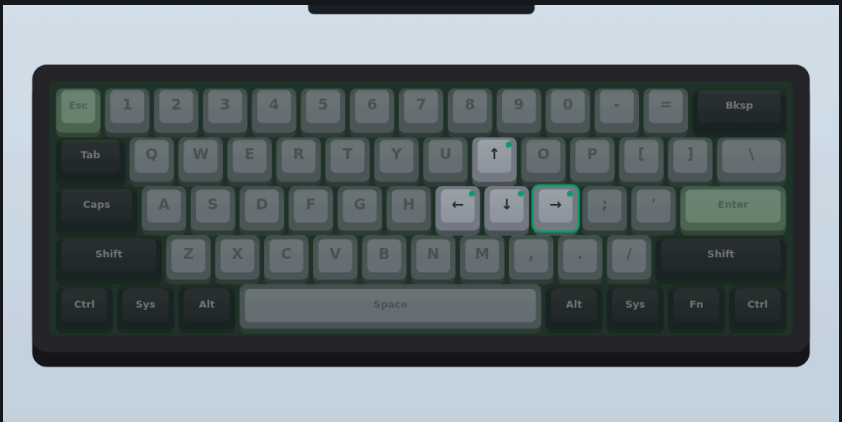
mytekDev

Keyboard Builder: A Keyboard Never Sends a Letter

Grades 7-10 · 45 minutes

Computer science · Technology



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 ten-minute walkthrough to rehearse before class, and background in plain words for the teacher
- 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 table of what five keys send
- 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 grades 5 and 6 and in grades 11 and 12
- Standards: CSTA 2017

Keyboard Builder: A Keyboard Never Sends a Letter

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A 61-key keyboard has no arrow keys. Students open its keymap, the table inside the keyboard that says what each key sends, and put the four arrows on I, J, K and L on a second layer reached by holding Fn. On the Type bench they press the same I key twice: once it sends code 0C and the computer shows an i, and with Fn held it sends code 52, the code for Up. They finish by making Caps Lock send Backspace.

At a glance

ESSENTIAL QUESTION

When you press a key, what does the keyboard really send, and who decides what it means?

OBJECTIVES

Students will be able to:

- explain that a keyboard sends a code for a key, and the computer turns the code into a character
- change what a key sends by editing the keymap
- use a second layer so one key can send two different codes
- name which part does each job: the switch, the keyboard's own program, and the computer

VOCABULARY

Key code, Keymap, Layer, Firmware, Macro

STANDARDS

3A-CS-02, 3A-CS-01

TIME AND MATERIALS

45 minutes, grades 7-10.

- 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/keyboardbuilder?lesson=a-keyboard-never-sends-a-letter&ref=tpt-keyboardbuilder-2 once on a student computer: it opens with the order Arrows under my fingers in hand, and checks that your school's filter allows the app. Run it yourself, about ten minutes: open the Keymap bench, click Layer 1, click the I key on the board and then Up under Moving, and do the same for J (Left), K (Down) and L (Right). The order closes. Press Try your keymap, click Fn on the board to hold it, and click I: the line under the board says layer 1 answered and the board sent code 52.

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. Every key on the drawn keyboard can be clicked, so no lesson needs a key a Chromebook does not have. Key sounds start off, and you can lock them off under Setup.

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: what goes down the cable when you press A? Write every answer on the board.	Answer the warm-up on the worksheet.
5 to 12	**Direct instruction (I do)** Model it	Project the app and open the Type bench. Click the keyboard, type a word, and read the line under the board aloud each time: a row, a column, a code, and what the computer turned it into. Hold Shift and press a letter: Shift is not sent as a key. Then open the Keymap bench and show that each cap is one row of a table. **It's working when:** Three parts, three jobs. The switch closes. The keyboard's own program looks up a code for that key in its keymap and sends it. The computer looks the code up in its keyboard layout setting and picks a character.	Watch, and fill in the vocabulary on the worksheet.
12 to 24	**Guided practice (We do)** Arrows on layer 1	Students open the link or scan the QR code. A short guide walks them through layer 1, the four arrows, and trying them on the Type bench. Ask: the cap still says I. What changed? **Watch for:** Students who put the arrows on layer 0. The order asks for layer 1, and on layer 0 they lose the letters. Put every key back is at the bottom of the panel.	Follow the guide. Fill in the first two rows of the table.
24 to 38	**Independent practice (You do)** Caps Lock, moved	Students take the order Nobody needs Caps Lock there: the Caps Lock key sends Backspace, and Caps Lock still has to live somewhere. Then they try it on the Type bench and finish the table. Walk the room with the What to look for questions. **If they ask:** "What code did the Fn key send to the computer? How does the computer know you are holding it?" The Fn key	Close the order, finish the table and answer the questions.
38 to 45	**Closure** Showcase and exit ticket	Show the Showcase slide. Two students say which part knows that I is now an arrow, then go back to the warm-up answers. Hand out the exit ticket.	Answer the exit ticket.

Before you teach: a ten-minute walkthrough

Open mytekdev.com/try/keyboardbuilder?lesson=a-keyboard-never-sends-a-letter&ref=tpt-keyboardbuilder-2. A short guide opens over the app. The keyboard is a 60 percent board, and the customer on the right has no arrow keys and wants them under their fingers. Open the Keymap bench: each cap now shows what its key sends on the layer you are looking at.

1. **Layer 1.** Click Layer 1. Every key fades, because a key with nothing on layer 1 is see-through: it does what layer 0 says.
2. **Four arrows.** Click the I key on the board. The panel reads "On layer 1 it sends whatever layer 0 says." Click Up under Moving. Do the same for J and Left, K and Down, L and Right. The order closes: "With Fn held, four letters are arrows."
3. **Try it.** Press Try your keymap. Click Fn on the board: it stays held, and the line under the board says the computer never hears it. Click I: "Layer 1 answered. The board sent code 52." Click Fn again to let go and click I: "The board sent code 0C. Your computer turned that into "i"."
4. **Caps Lock.** Take the order Nobody needs Caps Lock there. On layer 0, click the Caps Lock key and then Backspace under Editing. The customer says "Now I have no Caps Lock at all." On layer 1, click the same key and then Caps Lock under Editing. The order closes.

> The moment that lands is pressing I twice on the Type bench. The same switch closes both times, and two different codes go to the computer.

Background for the teacher

A keyboard does not know the alphabet. When a switch closes, the keyboard's own program, its firmware, looks up that key in a table called the keymap and sends the code it finds. The codes are the same on every USB keyboard: 04 for the A key, 0C for the I key, 52 for the Up arrow. The computer receives the code and looks it up again, in its keyboard layout setting, to choose a character. That is why the same keyboard types different characters when the computer is set to another language.

A layer is a second keymap on the same keys. While Fn is held, the firmware reads layer 1 in place of layer 0. Fn itself sends nothing to the computer: the keyboard handles it alone. Shift, Ctrl and Alt are different again. They are sent, but as eight on-or-off bits beside the key codes, not as keys.

Small keyboards depend on this. The 60 percent board has no arrows, no F keys and no number pad; they live on a second layer. A laptop does the same thing with its Fn key and the top row.

What to look for

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

- What did the keyboard send when you pressed I? What did the computer do with it?
- The cap says I and the key sends Up. Where is that decided?
- What does the Fn key send to the computer?
- Why did the customer say they had no Caps Lock at all, and how did you give it back?
- If the computer were set to another language, which would change: the code or the character?

> The last question is the real test: a student who says the code stays the same and the character changes has separated the keyboard's job from the computer's.

Cross-curricular extensions

- Math: the codes are written in base 16, where 0C means 12 and 52 means 82. What is 2A, the code for Backspace, in base 10?
- World languages: find a picture of a keyboard made for another language. Which keys moved, and which stayed?
- History: the letters on a keyboard are in an order chosen for typewriters in the 1870s. Find out what QWERTY was arranged for, and what is still argued about.
- Design: plan a layer 1 for someone who edits video or draws. Which eight keys would you give them, and where?

Vocabulary

Key code	The number a keyboard sends for a key. The letter is chosen later, by the computer.
Keymap	The table inside the keyboard that says which code each key sends.
Layer	A second keymap on the same keys, used while a key such as Fn is held.
Firmware	The program that runs inside the keyboard itself.
Macro	One key that presses a list of keys for you.

Differentiation

ENGLISH LEARNERS

- Keep the vocabulary slide up, and point at the screen as you say each word: the lit keys, the gold wires and the line under the board carry the meaning.
- Pair each learner with a partner; the caps on the board change as the keymap changes, so the screen shows the result of every click.
- Accept the table as codes and key names copied from the line under the board.

STUDENTS WITH IEPS OR 504 PLANS

- Pair students for the independent part, one at the app and one filling in the table.
- Zoom the browser to 125%; the board and the line under it stay readable.
- Allow the arrows order alone, where the IEP allows a modified assignment.

STUDENTS WHO NEED MORE SUPPORT

- A sentence starter: "The I key sent Up because the keyboard was on layer ___."

STUDENTS READY FOR MORE

- Take the order One key for a whole line. How many keys does the board press for "Thanks, Sam", and why is it more than the number of characters?

- A check-in after the guide: every student has typed with Fn held before anyone moves on.
- For Caps Lock, give the plan in two steps: on layer 0 make Caps Lock send Backspace, then on layer 1 make the same key send Caps Lock.
- Under Where the letters go, pick another layout and type your name. The caps did not change. What did?
- Set the level to High school and read the report the keyboard sends on the Type bench. Which part of it changes when you hold Shift?

Adapting for other grades

Younger students: In grades 5 and 6, leave the level on Middle school and do the guide together on the projector, with pairs sharing a computer, one clicking and one recording. Skip the third rubric row; total 8, and 6 meets the objectives. Say "the keyboard's list" for keymap until students have changed a key themselves.

Older students: In grades 11 and 12, set the level to High school: the Type bench shows the report the keyboard sends. Have students press Shift and a letter and find the bit that Shift turns on, then draw the layers from the switch to the character on screen and mark where the keymap and the computer's keyboard layout setting sit.

Student worksheet

Name: _____ Date: _____

Open the app: scan the QR code, or go to mytekdev.com/try/keyboardbuilder?lesson=a-keyboard-never-sends-a-letter

Essential question: When you press a key, what does the keyboard really send, and who decides what it means?

Warm-up: You press the A key and an "a" shows up. What do you think the keyboard sent down the cable?

_____

1. **Vocabulary.** Key code, keymap, layer, firmware, macro: write each in your own words.

2. **The table.** On the Type bench, press each key and copy from the line under the board: the code sent, and what the computer turned it into. The keys: I, then I with Fn held, then the Caps Lock key, then left Shift, then Fn.

1. The cap says I, and with Fn held the key sends Up. Which part made that happen: the switch, the keyboard, or the computer? How do you know?

2. What did the Fn key and the Shift key send that was different from a letter key?

Exit ticket

Name: _____

1. When you press a key, the keyboard sends (A) the letter on the cap (B) a code for that key (C) a picture of the letter

2. A layer lets a keyboard (A) send two different codes from one key (B) type faster (C) work without a cable

3. The same keyboard types different characters on a computer set to another language. Explain why.

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Answer key: exit ticket

QUESTION	ANSWER	WHY
1	B	The keyboard looks the key up in its keymap and sends a code. The computer chooses the character.
2	A	While Fn is held the keyboard reads a second keymap, so the I key can send the code for Up.
3	The computer turns codes into characters	The keyboard sends the same codes. The computer looks them up in its own keyboard layout setting, and that setting changed.

Rubric

Score each row from 1 to 4.

Name: _____

CRITERIA	4 EXCEEDS	3 MEETS	2 APPROACHING	1 BEGINNING
The keymap	Both orders closed: four arrows on layer 1, and Caps Lock sending Backspace with Caps Lock still reachable.	The arrows order closed.	Some arrows placed, order not closed.	No keys changed.
The table	All five keys, each with the layer, the code sent and what the computer made of it.	At least three keys recorded.	One or two keys recorded.	Nothing recorded.
Who does what	Says the keyboard sends a code from its keymap and the computer turns the code into a character, with an example from the table.	Says the keyboard sends a code, not a letter.	Says the keyboard sends the letter.	No answer.

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

Standards

Computing systems standards from CSTA 2017. Students open one everyday device and sort out which job belongs to its hardware, which to the program inside it, and which to the computer it is plugged into.

FRAMEWORK	CODE	GRADES	STANDARD	HOW THE LESSON MEETS IT
CSTA 2017	**3A-CS-02**	9-10	Compare levels of abstraction and interactions between application software, system software, and hardware layers.	Students follow one key press through the switch, the keyboard's firmware and keymap, and the computer's layout setting, and say what each layer adds.
CSTA 2017	**3A-CS-01**	9-10	Explain how abstractions hide the underlying implementation details of computing systems embedded in everyday objects.	Students explain what "press I, get an i" hides: a code, a keymap that can be changed, and a second layer on the same keys.

Checked November 2026 against: CSTA 2017 K-12 standards progression chart.

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/keyboard-builder/lessons/a-keyboard-never-sends-a-letter/start instead of the worksheet link. Each one gets their own copy of the starter, and the same link reopens it next time.

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