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Phone Lab: Test It, Fix It, Test It Again

Grades 6-8 · 45 minutes

Engineering design · 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 test 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 grades 4 and 5 and in grades 9 and 10
- Standards: NGSS engineering design

Phone Lab: Test It, Fix It, Test It Again

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Students put an untested phone on the bench and drop it one meter onto pavement, three ways. It survives two landings; flat on its back, the glass back cracks. They change the back to plastic, find the old result has been cleared, and test again: all three landings. Then the Pocket test shows what the fix cost, because keys scratch a plastic back. Students repeat the cycle for the Dunk and Fix it tests and record each fix and its cost.

At a glance

ESSENTIAL QUESTION

How do you fix a design that failed a test without breaking something else?

OBJECTIVES

Students will be able to:

- run a test and say exactly what failed
- change a design in response to a failed test, and test it again
- explain why a result no longer counts once the design has changed
- name what a fix cost somewhere else in the design

VOCABULARY

Test, Failure point, Iteration, Fair test, Trade-off

STANDARDS

MS-ETS1-4, MS-ETS1-3

TIME AND MATERIALS

45 minutes, grades 6-8.

- 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/phonelab?lesson=test-it-fix-it-test-it-again&ref=tpt-phonelab-3 once on a student computer: it opens on a plain gray phone, and checks that your school's filter allows the app. Run it yourself, about ten minutes: open Tests and press Drop (Survived 2 of 3 landings; flat on its back, the back cracked), press Back to the design, open Materials and pick a Plastic back, press Drop again (Survived all three landings), then press Pocket (keys scratch the back).

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 phone is turned by dragging, with a mouse or a trackpad. There are no brands, logos or real phone models in the app.

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: three ways a phone can land, and which is worst. Tally the votes on the board.	Answer the warm-up on the worksheet.
5 to 12	**Direct instruction (I do)** Model it	Project the app with the starter open. Open Tests and press Drop. Let all three landings play, then read the result aloud, line by line. Ask which part gave way, and what a designer could change. Do not change it yet. > **It's working when:** A useful result names the part that failed. "It broke" is not enough to fix anything.	Watch, and fill in the vocabulary on the worksheet.
12 to 24	**Guided practice (We do)** Test, fix, test again	Students open the link or scan the QR code. A short guide walks them through the drop, the plastic back, the second drop and the Pocket test. When the first result disappears, ask: where did it go, and is that fair? > **Watch for:** Students who are annoyed that the result was cleared. That is the point to make: the phone that passed is not the phone on the bench.	Follow the guide. Fill in the first two rows of the test log.
24 to 38	**Independent practice (You do)** Two more tests	Students run Dunk and Fix it, change the phone to pass each, test again, and then look for what the fix cost by running the other tests. Walk the room with the What to look for questions. > **If they ask:** "The dunk seal keeps water out. What did it do to the repair score, and why?" The seal	Finish the test log and answer the questions.
38 to 45	**Closure** Showcase and exit ticket	Show the Showcase slide. Two students name a fix and what it cost. Go back to the warm-up votes: which landing was worst for this phone? Hand out the exit ticket.	Answer the exit ticket.

Before you teach: a ten-minute walkthrough

Open mytekdev.com/try/phonelab?lesson=test-it-fix-it-test-it-again&ref=tpt-phonelab-3. A short guide opens over the app. The phone is the plain starting phone: an aluminum frame, a glass back, a splash seal, and a back held on with glue. Nothing has been tested.

1. **The drop.** Open Tests and press Drop. The phone falls a meter onto pavement three ways. The result reads "Survived 2 of 3 landings." Face down, the glass held. On a corner, the frame took it. Flat on its back, the back cracked.

2. **The fix.** Press Back to the design, open Materials and pick a Plastic back. The result under Drop is cleared. Press Drop again: "Survived all three landings."
3. **The cost.** Press Pocket. Keys on the glass leave no marks. Keys on the back: scratches. Sand on the back: deep scratches. With the glass back, only the sand left marks.
4. **Dunk.** Press Dunk: "Water got in." Under Water, repair and power pick Dunk for the water seal and test again: "Dry inside." Now press Fix it: the repair score is 4 out of 10 with the plastic back, one lower than it was with the splash seal.
5. **Fix it.** Hold the back on with Screws and press Fix it: 8 out of 10 with the dunk seal still on. With no seal it is 10, and the Dunk test fails again.

> The moment that lands is the Pocket test. Students think the plastic back solved the problem, and the keys show them the bill.

Background for the teacher

Engineers test to find the part that fails first, change it, and test again. Each round is an iteration. A result belongs to the design that was tested, so the app clears every result when the phone changes. A fix is a change like any other, and it has effects of its own: a plastic back does not crack and it scratches, a water seal keeps water out and has to be peeled off in a repair, screws make a repair easy and do nothing for water.

In the Pocket test, keys do not mark glass because the metal of a key is softer than glass. The grains in most sand are quartz, which is harder than glass, so sand scratches it. Plastic and bare metal backs are softer than both.

The app's tests give the same result every time for the same phone. A real drop is partly luck: the same phone can survive one fall and crack on the next. The app leaves the luck out so that a result belongs to the design. The phone in the app is a model: a simple stack of layers. Real phones fit their parts together more cleverly, and a real thin phone holds more battery than this one does, because its makers spread the battery wider. How much a battery holds for its size and how heavy each material is come from published figures. How deep a camera is, how many hours a charge lasts and how a drop goes are estimates, set so that a normal phone comes out normal.

What to look for

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

- Which landing did the phone fail, and which part gave way?
- You changed the back. Where did the Drop result go, and why?
- What did the plastic back cost you? Which test showed it?
- The dunk seal keeps water out. What did it do to the repair score?
- Is there a phone that passes every test? What would it give up?

> The third question is the real test: a student who goes looking for the cost of a fix, without being asked, has the idea.

Cross-curricular extensions

- Math: the repair score starts at 10. Glue takes off 3, a glass back with glue 1 more, the glue strips under the battery 1, a splash seal 1 and a dunk seal 2. Work out the score for three phones, then check each in the app.
- Science: geologists rank how hard a material is by what scratches what. Where would a key, glass and sand go on that list?
- English: write the test report for one test: what was tested, how, what happened, and what you recommend.
- At home: find one thing that was made easier to use and harder to repair. What is holding it together?

Vocabulary

Test	Trying a design under set conditions to see what happens.
Failure point	The part that gave way first in a test.
Iteration	One round of test, change, and test again.
Fair test	A test run the same way each time, on the design as it is now.
Trade-off	Getting more of one thing by giving up some of another.

Differentiation

ENGLISH LEARNERS

- Keep the vocabulary slide up, and point at the screen as you say each word: the card, the layers and the numbers carry the meaning.
- Pair each learner with a partner; the falling phone and the result lines carry the meaning.
- Accept the test log as the test name, pass or fail, and the part named on the screen.

STUDENTS WITH IEPS OR 504 PLANS

- Pair students for the independent part, one at the app and one recording.
- Press Skip to the end on a test for students who find the motion distracting; the result is the same.
- Allow one more test instead of two, where the IEP allows a modified assignment.

STUDENTS WHO NEED MORE SUPPORT

- A sentence starter: "It failed because the ___ ___. I changed ___. That cost me ___."
- A check-in after the guide: every student has two rows in the log before anyone goes on.
- Tell students where to look for the dunk fix: Water, repair and power.

STUDENTS READY FOR MORE

- Pass all five of Drop, Pocket, Dunk, Charger and Fix it on one phone. Is it possible? What is the closest you can get?
- Pick the Toughest front glass and run Pocket. What changed, and why might that be true of real glass?
- With the plastic back on, make the phone thinner until Drop fails again. Which landing failed, and what

hit the ground first?

Adapting for other grades

Younger students: In grades 4 and 5, do the guide together on the projector, with pairs sharing a computer, one changing the phone and one recording. Skip the third rubric row; total 8, and 6 meets the objectives. Use the words "what broke" for failure point until the second drop.

Older students: In grades 9 and 10, have students write a test plan before they touch the app: which test, what they expect, and what result would change their mind. Afterward ask what the app's tests leave out that a real drop has, and how a real lab deals with luck.

Student worksheet

Name: _____ Date: _____

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

Essential question: How do you fix a design that failed a test without breaking something else?

Warm-up: A phone falls off a table. Three ways it could land: _____, _____, _____. The worst: _____

1. **Vocabulary.** Test, failure point, iteration, fair test, trade-off: write each in your own words.

2. **The test log.** For each test write: the test, the result, the part that failed, what you changed, the result after, and what the fix cost somewhere else. Start with Drop, then Dunk and Fix it.

1. After you changed the back, the Drop result disappeared. Why is that fair?

2. Pick one fix you made. What did it cost somewhere else, and which test showed you?

Phone Lab: Test It, Fix It, Test It Again

Exit ticket

Name: _____

1. After a design is changed, its old test results (A) still count (B) no longer count, because it is a different design (C) count for half

2. A plastic back survived the drop that cracked the glass one. In the Pocket test the plastic back (A) was scratched by keys (B) was not marked (C) cracked

3. Name one fix from today and what it cost somewhere else.

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Answer key: exit ticket

QUESTION	ANSWER	WHY
1	B	A result belongs to the design that was tested.
2	A	Keys are softer than glass and harder than plastic.
3	A fix and its cost	A plastic back: scratches from keys. A dunk seal: a lower repair score. Screws with no seal: water gets in.

Rubric

Score each row from 1 to 4.

Name: _____

CRITERIA	4 EXCEEDS	3 MEETS	2 APPROACHING	1 BEGINNING
The test log	Three tests logged, each with the result, the part that failed, the fix, and the result after.	Two tests logged with a fix and a second result.	One test logged.	No tests logged.
The cost of a fix	Names what at least two fixes cost somewhere else, with the test that showed it.	Names what one fix cost.	Says a fix worked, with no cost.	No answer.
Testing again	Explains that a result belongs to the design that was tested, so a changed phone has to be tested again.	Says the phone had to be tested again after a change.	Says the result disappeared, with no reason.	No answer.

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

Standards

NGSS middle school engineering design. Students generate test data with a model, change the design in response, and compare the results of several versions.

FRAMEWORK	CODE	GRADES	STANDARD	HOW THE LESSON MEETS IT
NGSS	**MS-ETS1-4**	6-8	Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.	Students use a model to test a design, modify it and test again over several rounds. They use the model; they do not develop it.
NGSS	**MS-ETS1-3**	6-8	Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.	Students compare test results from several versions of the phone and say what each version does best.

Checked November 2026 against: NGSS MS-ETS1 Engineering Design.

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/phone-lab/lessons/test-it-fix-it-test-it-again/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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