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Phone Lab: The Best Phone Lost

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 comparison table for three designs
- 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

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Two phones have been designed for a grandparent who wants a big screen and a long day for under $700. Design 1 has the same big screen and a far longer day, and it sells for $830, so it breaks the must. Design 2 uses a cheaper screen, sells for $690, and meets the brief with 50 out of 100. Students compare them line by line, then build a third: the thick body of Design 1, the cheap screen of Design 2, and a cheaper frame to pay for it. It meets the brief with 69 out of 100 or more.

At a glance

ESSENTIAL QUESTION

How do you decide which of several designs is best, and prove it?

OBJECTIVES

Students will be able to:

- compare two designs against the same criteria and constraints
- use numbers from a comparison as evidence for a choice
- combine the best parts of two designs into a third
- say which design is best for a customer and which number shows it

VOCABULARY

Evaluate, Evidence, Criteria, Constraint, Solution

STANDARDS

MS-ETS1-2, 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=the-best-phone-lost&ref=tpt-phonelab-4 once on a student computer: it opens with a grandparent as the customer and two designs already kept, and checks that your school's filter allows the app. Run it yourself, about ten minutes: press Compare and read the two designs (Design 1 breaks a must, Design 2 has 50 out of 100), close it, pull Thickness up to 10.0 (the shop price reaches $700 and the must breaks), then under Materials pick a Plastic frame ($680, and

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.

Meets the brief: 69 out of 100). Press
Keep this design and Compare again.

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: two friends, two phones, who is right? Push for what best means, and best for whom.	Answer the warm-up on the worksheet.
5 to 12	**Direct instruction (I do)** Model it	Project the app with the starter open. Read the box For: a grandparent aloud: one must, two wants. Press Compare. Read Design 1 and Design 2 down the same rows: the battery, the weight, the shop price. Ask which one the class would pick, then read the last row. > **It's working when:** Comparing is fair when every design is read on the same rows. The last row is the customer's verdict: a score, or "breaks a must".	Watch, and fill in the vocabulary on the worksheet.
12 to 24	**Guided practice (We do)** Build Design 3	Students open the link or scan the QR code. A short guide walks them through Compare, the thick body, the price going over, and the cheaper frame. When the must breaks, ask: what just crossed the line? > **Watch for:** Students who fix the price by making the phone thin again. It works, and it gives back the long day they were after. Ask what else could be made cheaper.	Follow the guide. Fill in the columns for Design 1, Design 2 and Design 3.
24 to 38	**Independent practice (You do)** Beat it	Students try to beat their Design 3 and stay under $700, recording each try. A kept design can be removed in Compare to make room. Walk the room with the What to look for questions. > **If they ask:** "You say Design 3 is better than Design 2. Which row shows it?" Evidence	Record each try and choose a winner.
38 to 45	**Closure** Showcase and exit ticket	Show the Showcase slide. Two students name the design they would hand over and the number that proves it. 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/phonelab?lesson=the-best-phone-lost&ref=tpt-phonelab-4. A short guide opens over the app. The customer is a grandparent: "A big screen that is easy to read and a battery that goes well past a day, for under $700." Two designs are already kept, and the phone on the screen is the same as Design 2.

1. **Compare.** Press Compare. Design 1 is the Big shape, 10.0 millimeters thick: 7,450 mAh, more than a day, 220 grams, a shop price of $830. Its last row reads "breaks a must". Design 2 is the Big shape with an LCD screen,

8.0 thick: 4,500 mAh, about a day, 177 grams, $690, and "50 out of 100".

2. **The thick body.** Close the table. Pull Thickness up to 10.0. The battery holds 6,550 mAh. The shop price is now $700, which is not under $700, so the box reads "Breaks a must".
3. **Pay for it.** Under Materials pick a Plastic frame. The price falls to $680 and the box reads "Meets the brief: 69 out of 100". The phone weighs 197 grams.
4. **Keep and compare.** Press Keep this design, then Compare. Three designs, the same rows. Thickness 11.0 with the plastic frame reaches 83 and sells for $690. A Plastic back is cheaper still and lowers the score to 65 at 10.0: it is thicker than glass, so the battery behind it is smaller.

> The moment that lands is the last row of the first comparison. Design 1 wins the rows a student cares about and loses.

Background for the teacher

Comparing designs fairly takes a system: the same measures for every design, read side by side, against what the customer asked for. Engineers often use a table for this, sometimes with a weight on each row. The Compare table is that system. Its last row is the customer's verdict, and a design that breaks a must gets no score there, however good the rows above it look.

Neither starting design is right. Design 1 has the long day and costs too much, mostly because of its screen. Design 2 swaps to an LCD screen, which is cheaper and thicker, so it leaves less room for the battery. The better answer takes the thick body from one and the cheap screen from the other, then finds the money somewhere the customer will not miss it. That is what the standard means by combining the best characteristics of each.

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. The shop price is the cost of the parts times about two and a half.

What to look for

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

- Which design lasts longer? Which one meets the brief?
- Why did Design 1 lose?
- What did your Design 3 take from Design 1? What did it take from Design 2?
- When you made it thicker, the must broke. What crossed the line?
- Which design would you hand to the grandparent, and which row shows it?

> The last question is the real test: a student who points at a row of the table, not at how the phone looks, has the idea.

Cross-curricular extensions

- Math: Design 1 sells for $830 and the limit is $700. What percent over is it? How much would the parts have to fall, if the shop price is about two and a half times the parts?
- Science: an LCD screen has a light behind it that is always on. Why would that make the screen thicker?
- English: write the email to the grandparent that explains which phone you chose and why, with two numbers in it.
- At home: compare two things your family could buy, on the same three rows. Which row decides it?

Vocabulary

Evaluate	To judge how well a design does, using the same measures for every design.
Evidence	A number or a result that backs up a claim.
Criteria	What a design should do well. Each one can be scored.
Constraint	A line a design cannot cross.
Solution	One design that tries to solve the problem. There is usually more than one.

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 Compare table is the same rows for every design.
- Accept a circled number in the table in place of a written reason.

STUDENTS WITH IEPS OR 504 PLANS

- Pair students for the independent part, one at the app and one recording.
- Zoom the browser to 125%; the Compare table scrolls and stays readable.
- Allow one try at beating Design 3 instead of three, where the IEP allows a modified assignment.

STUDENTS WHO NEED MORE SUPPORT

- A sentence starter: "Design ___ is best for the grandparent because its ___ is ___."
- A check-in after the guide: every student has three designs in Compare before anyone goes on.
- Suggest the next change: turn Wireless charging off under Water, repair and power, and read the price.

STUDENTS READY FOR MORE

- What is the highest score you can reach under $700? Record the phone that gets it.
- Design 1 is $130 over. What is the fewest changes that bring it under $700, and what do they do to its score?
- Pick a different customer and decide which of your three designs suits them best. Does the winner change?

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. Read the Compare table together, one row at a time, before anyone builds Design 3.

Older students: In grades 9 and 10, have students build their own decision matrix on paper for the three designs: the criteria as rows, a weight for each, a score for each design, and a total. Compare their totals with the app's, and discuss what a must does that no weight can.

Student worksheet

Name: _____ Date: _____

Open the app: scan the QR code, or go to mytekdev.com/try/phonelab?lesson=the-best-phone-lost

Essential question: How do you decide which of several designs is best, and prove it?

Warm-up: Two friends each say their phone is the best. How could you find out who is right?

1. **Vocabulary.** Evaluate, evidence, criteria, constraint, solution: write each in your own words.

2. **The comparison table.** For Design 1, Design 2 and your Design 3 write: battery (mAh), how long it lasts, weight (grams), shop price, A big screen (out of 100), A long day (out of 100), and the last row.

3. **Beat it.** Each try: what I changed _____ shop price _____ score _____

1. Design 1 lasts far longer than Design 2 and has the same screen. Why did it lose?

2. Which design would you hand to the grandparent? Give the number that shows it is the best.

Phone Lab: The Best Phone Lost

Exit ticket

Name: _____

1. To compare two designs fairly you (A) pick the one that looks better (B) read both on the same measures (C) ask who made each one

2. Design 1 had the longest day of the three and sold for $830. For a customer who must pay under $700 it is (A) the best design (B) not a solution, because it breaks a must (C) the second best design

3. Your Design 3 used parts of two other designs. Name one thing it took from each.

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Exit ticket

Name: _____

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2. Design 1 had the longest day of the three and sold for $830. For a customer who must pay under $700 it is (A) the best design (B) not a solution, because it breaks a must (C) the second best design

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Answer key: exit ticket

QUESTION	ANSWER	WHY
1	B	The same rows for every design is what makes a comparison fair.
2	B	A design that breaks a constraint is not a solution to this problem, whatever it scores.
3	One thing from each	The thick body, or the long day, from Design 1. The LCD screen, or the lower price, from Design 2.

Rubric

Score each row from 1 to 4.

Name: _____

CRITERIA	4 EXCEEDS	3 MEETS	2 APPROACHING	1 BEGINNING
The comparison table	Three designs, each with the battery, the weight, the shop price, both wants and the last row.	Three designs with most rows filled in.	Two designs recorded.	One design or none recorded.
Combining designs	A third design that meets the must and beats Design 2, with what it took from each of the first two named.	A third design that meets the must and beats Design 2.	A third design that breaks the must.	No third design.
Evidence for the choice	Names the best design for the grandparent and gives the number or row that shows it, and says why Design 1 lost.	Names the best design and gives a number.	Names a design with no number.	No answer.

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

Standards

NGSS middle school engineering design. Students evaluate competing designs with a systematic process and combine the best of each.

FRAMEWORK	CODE	GRADES	STANDARD	HOW THE LESSON MEETS IT
NGSS	**MS-ETS1-2**	6-8	Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.	Students read three designs on the same rows of a comparison table against one customer's criteria and constraint, and choose with a number as evidence.
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 identify the best characteristic of each of two designs and combine them into a third that meets the criteria better.

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/the-best-phone-lost/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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