mytekDev

Flight Lab: Design, Test, Improve

Grades 6-8 · 45 minutes

Physical 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 rule log and a real-flight table
- 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 high school physics
- Standards: NGSS

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Students take the loop engineers use, test, change one thing, test again, and write it as a three-line trim rule. The app runs it: a flat dart dove 14 ft, the rule bent the back edges up 2, and the next throw glided 16 ft, so it stopped. Students change how much the rule bends at each step and find a better trim, then fold the classic dart from a printed plan, bend its back edges, and throw it for real.

At a glance

ESSENTIAL QUESTION

How do engineers improve a design, and can a rule do some of the testing?

OBJECTIVES

Students will be able to:

- describe the design loop: test, change one thing, test again
- run a trim rule and say what it decided after each throw
- change a rule and compare what it finds
- fold a plane from a plan and compare its real flight with the model

VOCABULARY

Iterate, Rule, Model, Trim, Prototype

STANDARDS

MS-ETS1-4, MS-ETS1-3

TIME AND MATERIALS

45 minutes, grades 6-8.

- One computer or Chromebook per student, with a mouse or trackpad
- A projector
- The worksheet and exit ticket, one copy each per student
- The rubric, one copy per student if you grade the work
- The classic dart's plan, printed before class at 100% (not fit to page), one per student and a few spares
- A hallway or gym with a clear throwing line, and a tape measure

PREP

Make copies of the worksheet and exit ticket. Print the plans: open mytekdev.com/try/flightlab?lesson=design-test-improve&ref=tpt-flightlab-4 on your computer, press Export, and under A plan to fold press Lines only, to save ink. The PDF downloads (or goes into your Files if you are signed in). Print its first page at 100%, not fit to page, one for each student. Then run the lesson yourself, about ten minutes: on Fly, press Try my

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 and no sound. 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.

rule (it dove 14 ft, bent the back edges up 2, glided 16 ft, stopped), change up 2 to up 8 and try it again, and fold one plan. Set the throwing rule before anyone folds: throw only along the line you are given, only when the way is clear, and never toward a face. The starter is set to feet and letter paper. The two buttons under Units on the Fly bench switch to meters (about a third as big).

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: write the steps you would follow until the plane flies well. Take two or three answers.	Answer the warm-up on the worksheet.
5 to 12	**Direct instruction (I do)** Model it	Project the app with the starter open. Press Fly and scroll to Your trim rule. Read the three lines aloud: they are the warm-up, written so the app can follow them. Press Try my rule and read the list. Show the rule slide and the stat slide. > **It's working when:** Each rule starts "when it", then a flight, a comma, and a change. The rule only sees what kind of flight it was, never how far it went, so it stops at the first glide.	Watch, and fill in the vocabulary on the worksheet.
12 to 22	**Guided practice (We do)** Run the rule together	Students open the link or scan the QR code. A short guide walks them through Try my rule, and changing up 2 to up 8. Then they try other sizes of change and record what each found. > **Watch for:** A highlighted line starting Line and a number: that line is one the lab cannot read. The button A rule to start from puts back a rule that works.	Fill in the rule log: the size of change, where it stopped, and the last glide.
22 to 40	**Independent practice (You do)** From the screen to paper	Hand out the printed plans. Students fold them, following the numbers, and bend the back edges as the plan says. Then, a few at a time, they throw along the line three times and measure each throw. Walk the room with the What to look for questions. > **If they ask:** "Your real plane landed somewhere else than the plan said. Name two things that are different about real paper and a real throw." Model and real	Fold, throw three times, fill in the real-flight table, and compare with the plan's last box.
40 to 45	**Closure** Showcase and exit ticket	Show the Showcase slide. Two students compare their real flights with the model, then go back to the warm-up rules. Hand out the exit ticket.	Answer the exit ticket.

Before you teach: a ten-minute walkthrough

Open mytekdev.com/try/flightlab?lesson=design-test-improve&ref=tpt-flightlab-4. A short guide opens over the app. It is the classic dart with its back edges flat, How hard 3, in the gym, standing.

1. **The rule.** Press `Fly` and scroll to Your trim rule. It reads: when it dives, bend the back edges up 2; when it climbs then dives, bend the back edges down 2; when it glides, stop.

2. **Try it.** Press `Try my rule`: a numbered list. It dove 14 ft, the rule bent the back edges up 2, it glided 16 ft, and the rule said stop. `Keep this trim` keeps the bend it found.
3. **Change it.** Change up 2 to up 8 and try again: it stops at a glide of 24 ft. Up 4 stops at 19 ft, up 6 at 22 ft, up 12 at 24 ft, up 16 at 21 ft.
4. **The plan.** Press `Export`. Under A plan to fold, press `Lines only, to save ink`. The first page is the sheet at full size with every crease numbered in the order to fold it; the last box says how far to bend the back edges and what flight Flight Lab expects from a gentle throw.

> The moment that lands is the first run: the rule stops at 16 ft, and a bend of 8 glides 24. They have to work out what the rule cannot see.

Background for the teacher

Engineers improve a design by changing one thing at a time, testing it, and keeping what worked. A trim rule is that loop written down: after each throw, the first line that fits what the plane did makes its change, and the app throws again, up to ten times. It is a simple feedback controller, like a thermostat.

The rule sees only the kind of flight, never the distance, so it stops at the first glide. Small steps stop early, at a short glide; big steps can jump past the best bend. A rule with no stop never settles: ten throws and it is still changing. Folding the plan builds a prototype, and comparing the real throw with the model is how engineers check a model.

Common mistakes: the rule knows the best answer; the model must be wrong when the real plane lands somewhere else; changing several things before the next throw. Flight Lab works out each flight from the folded shape and the throw. A few of its numbers are our own, set where no published measurement exists, so a real paper dart lands near the distances on screen, not exactly at them. Real throws also vary more than the app's, real paper softens with use, and the app never shows a stall: its short paper wings tip over before they would stall.

What to look for

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

- What did the rule do after the first throw, and why?
- Why did the rule stop at 16 ft when 24 is possible?
- What would the rule need to know to find the best bend?
- Did your real plane fly the way the plan said?
- Name two things that are different about real paper and a real throw.

> The third question is the real test: a student who says the rule needs to know how far each throw went has seen what a model can and cannot decide.

Cross-curricular extensions

- Computer science: rewrite the trim rule as a flowchart, with a loop and a stop.
- Math: find the average of your three real throws, and how far it is from the plan's distance.
- Building: fold the plan again with the back edges bent a little more, then a little less. Does the real plane glide farther or shorter, as the app says it should?
- English: write a short report: what you tested, what you changed, and what you would try next.

Vocabulary

Iterate	To test, change one thing, and test again, many times.
Rule	An instruction that says what to do when something happens: when it dives, bend the back edges up.
Model	Something that stands in for the real thing so you can test it quickly. Flight Lab is a model of a paper plane.
Trim	Small changes that make a plane fly steadily.
Prototype	A first real version of a design, built to test.

Differentiation

ENGLISH LEARNERS

- Keep the vocabulary slide up, and point at the screen as you say each word: the flight line, the plane and the slider numbers carry the meaning.
- Pair each learner with a partner; the rule's words are short and the same each line.
- Accept the real-flight table as numbers, and the comparison as a drawing.

STUDENTS WITH IEPS OR 504 PLANS

- Pair students for folding: one reads the step numbers, one folds.
- Pre-fold the first two steps of the plan for students who need it.
- Accept one real throw instead of three, where the IEP allows a modified assignment.

STUDENTS WHO NEED MORE SUPPORT

- A sentence starter: "The rule bent the back edges up ___ each time and stopped at ___ ft."
- A check-in after the guide: every student has run the rule twice before folding.
- Fold together, one step at a time, on the projector.

STUDENTS READY FOR MORE

- Set How hard to 5 with the dart as it came, and press Try my rule. How does the rule handle a plane that climbs, then dives?
- Change the rule so it keeps going after a glide. What happens after ten throws, and why does a rule need to know when to stop?
- Pick a contest on the Fly bench and improve a plane for it, one change at a time, with a written record of every throw.

Adapting for other grades

Younger students: In grades 4 and 5, do the guide together on the projector, then let pairs share a computer with one student on the mouse and one recording. Give them the numbers to try instead of asking them to choose. Skip the third rubric row; total 8, and 6 meets the objectives. Run the rule together on the projector and skip changing it; spend the time folding.

Older students: In high school, the trim rule is a feedback controller: compare it with a thermostat. Students explain why a big step can swing past the best trim and why the rule needs a measure of distance, not only the kind of flight, to find the best.

Student worksheet

Name: _____ Date: _____

Open the app: scan the QR code, or go to mytekdev.com/try/flightlab?lesson=design-test-improve

Essential question: How do engineers improve a design, and can a rule do some of the testing?

Warm-up: Your paper plane dives. Write the steps you would follow, over and over, until it flies well.

_____

1. **Vocabulary.** Iterate, rule, model, trim, prototype: write each in your own words.

2. **The rule log.** For each run: the rule bends up _____ each time; it stopped at back edges _____; its last glide _____ ft.

3. **The real flight.** The plan's last box says _____. My throws: _____ ft, _____ ft, _____ ft.

1. Why did the rule stop at a short glide? What would it need to know to find the best one?

2. How was your real plane different from the model, and why?

Flight Lab: Design, Test, Improve

Exit ticket

Name: _____

1. The trim rule says "when it glides, stop". Why might it stop before the best trim? (A) It only knows what kind of flight it was, not how far (B) It ran out of paper (C) It always finds the best

2. Engineers improve a design by (A) changing everything at once (B) changing one thing, testing, and keeping what worked (C) testing once

3. Your real plane flew a different distance from the one the model said. Give two reasons why.

Flight Lab: Design, Test, Improve

Exit ticket

Name: _____

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2. Engineers improve a design by (A) changing everything at once (B) changing one thing, testing, and keeping what worked (C) testing once

3. Your real plane flew a different distance from the one the model said. Give two reasons why.

Answer key: exit ticket

QUESTION	ANSWER	WHY
1	A	The rule sees only glide, dive or climb then dive, so the first glide stops it, short or long.
2	B	One change at a time shows what each change did.
3	Two real differences	Any two: real throws are never exactly the same speed or angle; real folds are not perfectly straight or even; real paper bends and softens; the air in a room moves; the model sets some numbers by our own tests. "The app is wrong" alone is half.

Rubric

Score each row from 1 to 4.

Name: _____

CRITERIA	4 EXCEEDS	3 MEETS	2 APPROACHING	1 BEGINNING
The rule log	At least three sizes of change, each with where it stopped and the last glide, and the best named.	Two sizes of change with where each stopped.	One run of the rule recorded.	No log.
The real plane	Folded from the plan, three throws measured, and compared with the plan's last box.	Folded and thrown, with at least one throw measured.	Folded but not thrown or measured.	Not folded.
Model and real	Names two differences between the model and the real throw, and says how each changes the flight.	Names one difference between the model and the real throw.	Says it flew differently, with no reason.	No answer.

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

Standards

The lesson is built for MS-ETS1-4: a model, and a rule that runs it, generate data to test and improve a design, then a prototype is built and tested. MS-ETS1-3 covers comparing what each version of the rule found.

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 the app and a trim rule to generate data for iterative testing and modification, then fold and test a real prototype.
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 the trims several versions of the rule found and identify the 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/flight-lab/lessons/design-test-improve/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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