Studies

Six studies to run — and one rule: change one thing, hold the rest still

THIS BOOK BELONGS TO

....

Colour a badge in each time you finish a study

Cutting Up A Circle Sheets 9–13	**Getting It Back Out** Sheets 14–18	**The Square That Folds** Sheets 19–23
Hotter Is Not More Sheets 24–28	**Two Accounts, One Event** Sheets 29–33	**Which Denominator** Sheets 34–38

The four beats

Predict	Isolate	Test	Explain
write it down before you know	one change, everything else held	run it, more than once	why, not just what

Grown-ups: the **Isolate** beat is the point of this volume, and it comes *before* the test on purpose. Grade 7 science expects a student to distinguish a scientific experiment from research and from engineering design — and the thing that makes something an experiment is that exactly one variable moves. Writing down what is being held still, before running anything, is the whole skill.

Grade 7 · six studies · 46 sheets

Independent, dependent, controlled

Three names for three jobs. Every study in this book needs all three written down before it starts.

name them | check

The three kinds of variable

Independent — the one thing you change on purpose. There is only ever one.
Dependent — the thing you measure. It depends on what you changed.
Controlled — everything you deliberately hold still. There are usually a lot of these.

The study	Independent	Dependent	Two you must control
Does a wider wing make a plane fly further?			
Does hot water dissolve sugar faster?			
Does a triangle hold more weight than a square?			

The trap. Somebody tests a wider wing and also throws it harder, because the bigger plane feels like it needs more effort. What has gone wrong, and what can they now conclude?

Nothing. They can conclude nothing at all — because two things changed and there is no way to tell which one did the work. That is what an uncontrolled variable costs you.

Which process is this?

Research, experiment, or engineering design. They are three different things and Grade 7 expects you to know which one a job needs.

sort | justify

Research
Answer a question from sources somebody else made. No variable to change.

Experiment
Change exactly one thing and measure what happens. Needs a control.

Engineering design
Solve a problem against constraints. Success is "does it work", not "what happened".

The job	Which process?	Why
Build a bridge from 20 straws that holds a full mug		
Find out how road salt affects freshwater		
Test whether more wedges make the circle look more like a rectangle		
Work out which separation method suits a given mixture		

The clearest test. Ask: *is there a variable to change?* If not, it is not an experiment. Apply that to the first row.

A design task can contain experiments. You might test two joint types while building the bridge. But the bridge itself is a design problem.

Grown-ups: a student who can say "this is design, not an experiment, because there is no variable to test" has met the hardest part of `A1`.

Predicting, and not editing it

Same rule as last year, and it still matters. Write it down where you cannot quietly improve it later.

predict   check later

Question	My prediction, before I check	Right?
Cut a circle into wedges and rearrange — what shape do you get?		
Can you get both the salt and the water back from salt water?		
How many extra strips does a square need to stop folding?		
Which holds more heat — a lit match or a warm bath?		
Can two accurate accounts of one event disagree?		
Can changing the denominator reverse a ranking?		

Fill the last column as you finish each study. Do not touch the middle column.

One year on. If you did Grade 6's Cases, how many of your six predictions were right? Is that a good number?

Three or four is healthy. Six out of six means you were only predicting things you already knew.

Grown-ups: hindsight bias is universal. The instruction not to edit is doing real work.

How many times is enough?

Grade 5 taught you to repeat. Grade 7 asks the harder question — how many repeats, and how do you know when the spread is telling you something?

measure | compare

✓ Two sets of five readings

A: 4.1, 4.2, 4.1, 4.2, 4.1 B: 2.8, 5.4, 3.9, 4.9, 3.2

Both average about 4.1. Only one of them is worth reporting as 4.1.

	Set A	Set B
Mean		
Range		
Would you trust the mean?		

What does a wide spread mean? Name two different things it could be telling you — one about your method, one about the thing you are measuring.

A wide spread is information, not failure. It either means your method is imprecise, or it means the thing genuinely varies. Those need different responses.

Grown-ups: distinguishing measurement error from real variation is a genuinely advanced idea and Grade 7 can hold it.

Safety, and looking after things

One study involves heating water and one involves separating a mixture. Read this properly, once.

check agree

Hot water

- ☐ An adult does any boiling, or supervises it
- ☐ Hot tap water is enough for most of study 4
- ☐ Never heat a sealed container
- ☐ Thermometer in the liquid, not resting on the bottom

Mixtures

- ☐ Kitchen materials only — salt, sand, sugar, iron filings, water
- ☐ Never mix cleaning products, of any kind, for any reason
- ☐ Do not taste anything, even if you know what it is
- ☐ Wash your hands afterwards

The one that is not negotiable. Never combine household cleaning products to see what happens. Bleach and ammonia make a toxic gas, and so do several other ordinary combinations. This is not a rule about being careful — it is the one experiment you do not run.

Signed: .... Date: ....

Grown-ups: the cleaning-products warning is stated plainly and without softening. It is the one genuine hazard in this book.

What you will need

Almost all of it is in the kitchen. Tick what you have.

✓ gather

Study	What it needs	Got it?
1 · Cutting Up A Circle	paper, compass or a round lid, scissors, ruler, glue	
2 · Getting It Back Out	salt, sand, water, coffee filter or kitchen roll, two jars, a warm windowsill	
3 · The Square That Folds	card strips, split pins or paper fasteners, a hole punch, small weights	
4 · Hotter Is Not More	a thermometer, two containers of different sizes, hot tap water, a timer	
5 · Two Accounts, One Event	two sources about the same event, and a way to take notes	
6 · Which Denominator	squared paper, a ruler, a calculator	

No split pins? Paper clips bent open work, and so does a needle and thread. Write what you would substitute — choosing one is part of the work.

Study 2 needs a day or two for the water to evaporate. Start it early and let it sit while you do study 3.

Grown-ups: nothing here needs buying. A thermometer is the only item some households will not have; a cooking one is fine.

How a study is laid out

Five sheets, same order every time. The second one is the new one.

read

Sheet	Beat	What happens
1	The brief	What the study is, what you need, and the four beats laid out
2	Predict	Write down what you think, before anything else
3	Isolate	Name the one thing you will change, and everything you will hold still
4	Test	Run it. More than once. Record the messy parts too
5	Explain	Why it happened — not just what happened

Sheet 3 is the new one, and it comes before the test. That order is deliberate. Deciding what to hold still *after* you have seen the result is how people accidentally talk themselves into conclusions. Writing it first is what makes the test mean something.

Before you start. Which study are you most looking forward to, and why?

Grown-ups: if time is short, the beat to protect is **Isolate**. Predict, Test and Explain are familiar from earlier volumes.

Your study record

One row per study. The whole book on one page.

keep it up

Study	What I changed	What I held still	What I measured	Prediction right?
1 Cutting Up A Circle				
2 Getting It Back Out				
3 The Square That Folds				
4 Hotter Is Not More				
5 Two Accounts				
6 Which Denominator				

Look down the "held still" column at the end. Which study needed the longest list — and why do you think that was?

The messier the situation, the longer that column gets. That is why studies of people are harder than studies of circles.

Grown-ups: the closing observation — that human situations need far more controls — is a genuinely sophisticated one and worth discussing.

Cutting Up A Circle

Five sheets · you need paper, a round lid, scissors, a ruler and glue

read it | get ready

You have been given πr^2 and told to trust it. This study makes you earn it. Cut a paper circle into wedges, lay them alternately point-up and point-down, and watch a rectangle appear that is πr long and r high.

The four beats

Predict
What shape do the rearranged wedges make?

Isolate
Change the number of wedges. Hold the circle the same

Test
Do it with 8, then 16, then 32

Explain
Why the rectangle is πr by r

Before you turn the page. What do you already know about this? Write it down — even if it turns out to be wrong.

Write it down first

Before anything else. A prediction only counts if it exists before the evidence does.

predict | say why

Cut a circle into thin wedges and lay them alternately point-up and point-down. What shape do you get?

- ☐ a circle again
- ☐ something close to a rectangle
- ☐ a triangle
- ☐ a random mess

Why do you think that? One sentence. You will want to reread it afterwards.

Also predict whether more wedges makes it closer to that shape, or further away.

One change, everything else held

The new beat, and it comes before the test on purpose. Decide the control now, not after you have seen the result.

design it | commit

The one thing I am changing the independent variable

The number of wedges you cut the circle into

In my own words, and exactly how I will change it:

What I am holding still the controlled variables — tick each as you set it up

- [ ] the size of the circle
- [ ] the paper you use
- [ ] how carefully you cut
- [ ] how you lay them out

One more that is not on the list: ....

What I am measuring the dependent variable

How close the result is to a rectangle — measure the top edge and check whether it is straight

The units I will use, and how many times I will repeat it:

If you also changed the circle size, you could not tell whether the improvement came from more wedges or a bigger circle.

Run it

Three circles, all the same size. Cut into 8, 16 and 32 wedges.

test record

Wedges	Length of the long edge	Height	Straight or bumpy?

Cut every circle from the same lid. That is the control you wrote down on the last sheet.

Draw what you actually set up — not a diagram from a book.

Did anything you promised to hold still slip? Be honest. It changes what you can conclude.

Why, not just what

Describing says what happened. Explaining says why. Only one of those is being marked here.

reason explain

The long edge came out at about πr and the height at about r. Explain why — where does each of those come from?

Now use it. A circle of radius 5 cm: what is its area? And a circle of radius 10 cm — is the area double, or something else?

Back to your prediction. Was it right? If not, what were you assuming that turned out not to hold?

Doubling the radius quadruples the area, because r appears twice in πr^2. A 12-inch pizza is four times a 6-inch one, not two.

Study 1 finished. Go and colour in badge 1 on the cover.

Getting It Back Out

Five sheets · you need salt, sand, water, a filter, two jars and a windowsill

read it · get ready

A mixture looks like one thing and separates into several. Which method works depends entirely on how the parts differ — by size, by whether they dissolve, or by boiling point. You are going to pick the property and exploit it.

The four beats

Predict
Which method gets the salt back, and which gets the water?

Isolate
Change the separation method. Hold the mixture the same

Test
Filter one sample, evaporate another

Explain
Which property each method used

Before you turn the page. What do you already know about this? Write it down — even if it turns out to be wrong.

Write it down first

Before anything else. A prediction only counts if it exists before the evidence does.

predict | say why

You have salt water and sandy water. Which method suits which?

- ☐ filtration separates the sand
- ☐ filtration separates the salt
- ☐ evaporation recovers the salt
- ☐ evaporation recovers the water

Why do you think that? One sentence. You will want to reread it afterwards.

Two of those four are right. Say why the other two are not.

One change, everything else held

The new beat, and it comes before the test on purpose. Decide the control now, not after you have seen the result.

design it | commit

The one thing I am changing the independent variable

The separation method you use

In my own words, and exactly how I will change it:

What I am holding still the controlled variables — tick each as you set it up

- ☐ the same mixture, made the same way
- ☐ the same amount of water
- ☐ the same temperature
- ☐ the same container

One more that is not on the list: ....

What I am measuring the dependent variable

Whether the method separated the parts, and what you were left holding at the end

The units I will use, and how many times I will repeat it:

If you filtered one mixture and evaporated a different one, you would be comparing mixtures rather than methods.

Run it

Make one batch of salt water and one of sandy water. Try both methods on each.

test | record

Mixture	Method	What came through	What was left behind

Evaporation takes a day or two on a warm windowsill. Start it before you do study 3.

Draw what you actually set up — not a diagram from a book.

Did anything you promised to hold still slip? Be honest. It changes what you can conclude.

Grown-ups: asking directly whether a control slipped gets a far more useful answer than hoping none did.

Why, not just what

Describing says what happened. Explaining says why. Only one of those is being marked here.

reason

explain

Filtration worked on one mixture and not the other. Using particle theory, explain why.

Evaporation gives you the salt back but loses the water. Distillation gives you both. Draw how you would collect the water vapour — and say what you would need.

Back to your prediction. Was it right? If not, what were you assuming that turned out not to hold?

Filtration exploits particle size. Evaporation exploits boiling point. Neither works unless the parts actually differ in that property.

Study 2 finished. Go and colour in badge 2 on the cover.

Grown-ups: "what were you assuming that turned out not to hold" is the question that turns a wrong prediction into learning.

The Square That Folds

Five sheets · you need card strips, split pins, and small weights

read it | get ready

Pin four strips into a square and push a corner — it collapses into a rhombus. Do the same to a triangle and nothing happens. That single difference explains why every bridge, roof and crane you have ever seen is full of triangles.

The four beats

Predict
How many extra strips does a square need?

Isolate
Change the bracing. Hold the material and joints the same

Test
Load each shape until it deforms

Explain
Which forces each strip is carrying

Before you turn the page. What do you already know about this? Write it down — even if it turns out to be wrong.

Write it down first

Before anything else. A prediction only counts if it exists before the evidence does.

predict

say why

A pinned square deforms when you push a corner. How many extra strips does it need to stop?

- ☐ one, across a diagonal
- ☐ two, across both diagonals
- ☐ four, one per side
- ☐ it cannot be stopped

Why do you think that? One sentence. You will want to reread it afterwards.

Also predict what the extra strip *creates* — the answer is a shape you already know.

Grown-ups: resist correcting a wrong prediction here. It is worth far more left standing.

One change, everything else held

The new beat, and it comes before the test on purpose. Decide the control now, not after you have seen the result.

design it

commit

The one thing I am changing the independent variable

The bracing you add to the shape

In my own words, and exactly how I will change it:

What I am holding still the controlled variables — tick each as you set it up

- ☐ the same card, cut to the same length
- ☐ the same pins, tightened the same
- ☐ the same place you push
- ☐ the same amount of force

One more that is not on the list: ....

What I am measuring the dependent variable

How far the corner moves before the shape gives way, and how much weight it holds

The units I will use, and how many times I will repeat it:

A tighter pin on one shape would look exactly like better bracing. That is why the joints are on the hold-still list.

Run it

Build a square, a braced square and a triangle. Load each one the same way.

test record

Shape	Weight when it first moved	How far it moved	What failed first

Push in the same place, with the same hand, every time. Note down when you did not.

Draw what you actually set up — not a diagram from a book.

Did anything you promised to hold still slip? Be honest. It changes what you can conclude.

Grown-ups: asking directly whether a control slipped gets a far more useful answer than hoping none did.

Why, not just what

Describing says what happened. Explaining says why. Only one of those is being marked here.

reason | explain

A triangle cannot change shape without changing the length of a side. A square can. Explain why that single fact settles the whole study.

Now name the forces. In your braced square, which strip is being squashed (compression) and which is being stretched (tension)?

Back to your prediction. Was it right? If not, what were you assuming that turned out not to hold?

Static load is the structure's own weight, day after day. Dynamic load is a truck crossing, or wind. Dynamic loads are what actually break things.

Study 3 finished. Go and colour in badge 3 on the cover.

Grown-ups: "what were you assuming that turned out not to hold" is the question that turns a wrong prediction into learning.

Hotter Is Not More

Five sheets · you need a thermometer, two containers, hot tap water and a timer

read it | get ready

A lit match is at a far higher temperature than a bathtub, and the bathtub contains vastly more heat. Almost every adult mixes these up. You are going to separate them by changing the amount of water while holding the temperature still.

The four beats

Predict
Which cools faster — a small cup or a large jug?

Isolate
Change the amount of water. Hold the starting temperature

Test
Two containers, same start, timed readings

Explain
Why temperature and heat are different quantities

Before you turn the page. What do you already know about this? Write it down — even if it turns out to be wrong.

Write it down first

Before anything else. A prediction only counts if it exists before the evidence does.

predict | say why

Two containers of water start at exactly the same temperature. One holds 100 mL, the other 500 mL. Which cools to room temperature first?

- ☐ the small one
- ☐ the large one
- ☐ both at the same rate
- ☐ depends on the container shape

Why do you think that? One sentence. You will want to reread it afterwards.

They start at the same *temperature*. Do they contain the same amount of *heat*?

Grown-ups: resist correcting a wrong prediction here. It is worth far more left standing.

One change, everything else held

The new beat, and it comes before the test on purpose. Decide the control now, not after you have seen the result.

design it | commit

The one thing I am changing the independent variable

The amount of water in the container

In my own words, and exactly how I will change it:

What I am holding still the controlled variables — tick each as you set it up

- ☐ the starting temperature, checked with the thermometer
- ☐ the room the containers sit in
- ☐ the container material — both glass, or both plastic
- ☐ the same thermometer, read the same way

One more that is not on the list: ....

What I am measuring the dependent variable

The temperature of each container every two minutes, for twenty minutes

The units I will use, and how many times I will repeat it:

Different container materials would change the cooling rate all by themselves, and you would learn nothing about the amount of water.

Run it

Same start temperature, different volumes. Read both every two minutes.

test record

Minutes	Small container °C	Large container °C	Difference

Getting both to the same starting temperature is the fiddly part. Do it properly — it is the control the whole study rests on.

Draw what you actually set up — not a diagram from a book.

Did anything you promised to hold still slip? Be honest. It changes what you can conclude.

Grown-ups: asking directly whether a control slipped gets a far more useful answer than hoping none did.

Why, not just what

Describing says what happened. Explaining says why. Only one of those is being marked here.

reason | explain

Both started at the same temperature, and the small one cooled faster. Using particle theory, explain what temperature measures and what heat measures.

A spark from a fire is at hundreds of degrees and barely hurts when it lands on you. A bath at 45°C would scald you. Explain that using this study.

Back to your prediction. Was it right? If not, what were you assuming that turned out not to hold?

Temperature is how fast the particles are moving. Heat is the total energy transferred — which depends on the temperature AND on how much stuff there is.

Study 4 finished. Go and colour in badge 4 on the cover.

Grown-ups: "what were you assuming that turned out not to hold" is the question that turns a wrong prediction into learning.

Two Accounts, One Event

Five sheets · you need two sources about the same event, and somewhere to take notes

read it | get ready

Two accounts of one event disagree. Your instinct is to decide which is biased and throw it away. Grade 7 asks for something harder: work out what actually varies between them, and reach a defensible position anyway.

The four beats

Predict
Will two accounts of one event agree on the facts?

Isolate
Change the source. Hold the event the same

Test
Compare them line by line

Explain
Why they differ, and what you can still conclude

Before you turn the page. What do you already know about this? Write it down — even if it turns out to be wrong.

Write it down first

Before anything else. A prediction only counts if it exists before the evidence does.

predict | say why

Two accounts of the same historical event, written by different people. What will they disagree about?

- ☐ the checkable facts — dates, numbers, places
- ☐ what the event meant
- ☐ who was responsible
- ☐ nothing much

Why do you think that? One sentence. You will want to reread it afterwards.

Tick as many as you think. Then rank them: which kind of disagreement is hardest to settle?

Grown-ups: resist correcting a wrong prediction here. It is worth far more left standing.

One change, everything else held

The new beat, and it comes before the test on purpose. Decide the control now, not after you have seen the result.

design it | commit

The one thing I am changing the independent variable

Which source you are reading

In my own words, and exactly how I will change it:

What I am holding still the controlled variables — tick each as you set it up

- [ ] the event itself — both must describe the same thing
- [ ] the questions you ask of each one
- [ ] how carefully you read — give each the same attention
- [ ] your own starting opinion, as far as you can

One more that is not on the list: ....

What I am measuring the dependent variable

What each source claims, who made it, when, for whom — and what each one leaves out

The units I will use, and how many times I will repeat it:

If you read one source carefully and skimmed the other, you would find more in the first — and conclude something about the sources that was really about you.

Run it

Compare them line by line. Same questions to both.

test   record

Question	Source 1	Source 2

Ask both: who made it, when, for whom, what does it claim, what does it leave out, and could you check it?

Draw what you actually set up — not a diagram from a book.

Did anything you promised to hold still slip? Be honest. It changes what you can conclude.

Grown-ups: asking directly whether a control slipped gets a far more useful answer than hoping none did.

Why, not just what

Describing says what happened. Explaining says why. Only one of those is being marked here.

reason | explain

Sort your disagreements into two piles: conflicts about facts, and conflicts about interpretation. Which pile is bigger, and which could in principle be settled?

Now take a position on the event that accounts for *both* sources — not one that ignores the inconvenient one.

Back to your prediction. Was it right? If not, what were you assuming that turned out not to hold?

A factual conflict can sometimes be settled with more evidence. An interpretive conflict usually cannot, and honest historians say so.

Study 5 finished. Go and colour in badge 5 on the cover.

Grown-ups: "what were you assuming that turned out not to hold" is the question that turns a wrong prediction into learning.

Which Denominator

Five sheets · you need squared paper, a ruler and a calculator

read it | get ready

Three countries, one set of true numbers, and two different rankings depending on whether you divide by population. Nobody lies at any point. This is how real arguments about emissions and resources are actually conducted.

The four beats

Predict
Can changing the denominator reverse a ranking?

Isolate
Change the denominator. Hold the data the same

Test
Rank three countries both ways, then graph both

Explain
Which figure answers which question

Before you turn the page. What do you already know about this? Write it down — even if it turns out to be wrong.

Write it down first

Before anything else. A prediction only counts if it exists before the evidence does.

predict | say why

Country A: 40 million people, 800 million units. Country B: 400 million people, 4 000 million units. Country C: 10 million people, 300 million units. Can the ranking reverse?

- ☐ no — the numbers are the numbers
- ☐ yes, if you divide by population
- ☐ yes, but only by cheating
- ☐ not sure

Why do you think that? One sentence. You will want to reread it afterwards.

Work out one of them per person before you commit, if you want. But write your answer down either way.

One change, everything else held

The new beat, and it comes before the test on purpose. Decide the control now, not after you have seen the result.

design it · commit

The one thing I am changing the independent variable

Whether you rank by total or by amount per person

In my own words, and exactly how I will change it:

What I am holding still the controlled variables — tick each as you set it up

- [ ] the same three countries
- [ ] the same underlying figures
- [ ] the same graph type
- [ ] the same axis starting point

One more that is not on the list: ....

What I am measuring the dependent variable

The rank order of the three countries under each method

The units I will use, and how many times I will repeat it:

If you also changed where the axis started, you would not know whether the different impression came from the denominator or from the scale.

Run it

Work out both figures, rank them both ways, then draw both graphs.

test record

Country	Population	Total	Per person	Rank by total	Rank per person

Same graph type, same axis start, for both. The only difference is what you plotted.

Draw what you actually set up — not a diagram from a book.

Did anything you promised to hold still slip? Be honest. It changes what you can conclude.

Why, not just what

Describing says what happened. Explaining says why. Only one of those is being marked here.

reason explain

Both rankings come from true numbers. Explain what question each one actually answers — and why they are different questions.

You are writing about this and you want the reader to think Country B is the biggest problem. Which figure do you quote? Now say what you owe the reader.

Back to your prediction. Was it right? If not, what were you assuming that turned out not to hold?

Neither figure is a lie. Which one gets quoted is a choice, and knowing that is the whole point of the study.

Study 6 finished. Go and colour in badge 6 on the cover.

Grown-ups: "what were you assuming that turned out not to hold" is the question that turns a wrong prediction into learning.

Read your hold-still lists

Go back through the six Isolate sheets. That column is the real record of what you learned.

review | compare

Study	How many things you held still	Did any of them slip?
1 Cutting Up A Circle		
2 Getting It Back Out		
3 The Square That Folds		
4 Hotter Is Not More		
5 Two Accounts		
6 Which Denominator		

Which study needed the longest list? Why do you think that one was hardest to control?

Where something slipped, what could you still conclude? And what could you not?

Study 5 was the awkward one — you cannot really hold your own opinion still while reading, and admitting that is more honest than pretending you can.

Grown-ups: noticing that some variables cannot be fully controlled — especially in human situations — is a genuinely mature insight.

Six studies, one move

Every study changed exactly one thing. The subject changed each time; the method did not.

connect | name it

Study	Subject	The one thing that changed	What that let you conclude
1	Math		
2	Science · Mixtures		
3	Science · Structures		
4	Science · Heat		
5	History		
6	Geography · Data		

Studies 5 and 6 are not laboratory science at all. Explain how the same method still worked on a historical source and on a set of statistics.

Where would this help outside school? Name a real claim you could test by holding everything but one thing still.

That is what "nothing is just one thing" means as a method. Find the parts, hold all but one still, and see what the one you moved was doing.

Study 7 — one you design

Same four beats. Your question, and your controls.

choose design

A good study question has three properties. There is exactly one thing you could change. You can measure the result. And you do not already know the answer.

My question: ....

My prediction: ....

	Mine
Independent the one thing I change	
Dependent what I measure, and in what units	
Controlled list at least four	
Repeats how many, and why that many	

Check it. Is there exactly one independent variable? If you can find a second one hiding, name it now.

Grown-ups: "find the second variable hiding" is the most valuable question on the page. There usually is one.

Run it

Your data. Record the readings you did not like as well as the ones you did.

test record

Setting of the thing I changed	Run 1	Run 2	Run 3	Mean	Range

Graph it. Independent variable along the bottom, dependent up the side, axis labelled and starting where you say it does.

Did a control slip?

Explain it

The last beat. Why, not just what — and be clear about what you cannot claim.

reason | explain

What happened, and why it happened

What I can claim

What I cannot because of what slipped, or what I never controlled

If you ran it again tomorrow, what one thing would you change about the *method* — not the question?

The right-hand box is the sign of a good scientist. Naming the limits of your own study is not weakness — it is what makes the rest of it believable.

Write it up for somebody else

One page. Somebody who was not there should be able to run it again and get your result.

write up | present

Must be on it

- [ ] The question
- [ ] What you changed, what you measured, and everything you held still
- [ ] How many repeats, and the spread — not just the mean
- [ ] A graph with a labelled axis and an honest starting point
- [ ] Your explanation, and what you cannot claim

The real test. Give it to somebody and ask whether they could run your study from it alone. What did they say was missing?

Grown-ups: "could somebody else repeat this from your write-up?" is what reproducibility means, and it is the honest test of a method section.

What you can do now that you couldn't

Tick honestly. A blank is information.

✓ tick

- ☐ I can name the independent, dependent and controlled variables
- ☐ I know that two changes means you can conclude nothing
- ☐ I report the spread, not just the mean
- ☐ I can say what I cannot claim
- ☐ I know why filtration works on sand and not on salt
- ☐ I know heat and temperature are different quantities
- ☐ I write the controls down *before* I test
- ☐ I can tell an experiment from research and from design
- ☐ I say when a control slipped
- ☐ I derived πr^2 by cutting a circle up
- ☐ I know why structures are full of triangles
- ☐ I know a denominator can reverse a ranking

The one I am proudest of

The one I want to get better at

Grown-ups: rows two, six and seven are the ones that matter most. Writing controls in advance, admitting a slip, and naming a limit are rare in adults.

All strands

Where the studies came from

Every study is built on a real Grade 7 expectation. Here is which one, and how confident I am about it.

Study	Expectation	Verified?
1 Cutting Up A Circle	Math **E2.5** — show the relationships between radius, diameter and area, and use them to *develop the formula* for the area of a circle.	✅ verified
2 Getting It Back Out	Science **C2** — the nature of matter, including pure substances and mixtures, described using *particle theory*. **C1** — evaluate impacts of use and disposal.	✅ strand and overall expectations verified
3 The Square That Folds	Science **Strand D** — Form, Function, and Design of Structures.	✅ strand name verified — it is **not** the 2007 title "Form and Function" · specific codes not checked
4 Hotter Is Not More	Science **Strand E** — Heat in the Environment, including the difference between heat and temperature.	✅ strand name verified · specific codes not checked
5 Two Accounts, One Event	History **Strands A and B** — and the historical thinking concepts, especially *perspective*.	✅ both strand names verified · specific codes not checked
6 Which Denominator	Geography **Strand B** — Natural Resources around the World. Math **D1.6** and **B2.10**.	✅ strand name and both math codes verified

The mathematics codes are verified individually against the Ministry expectations chart. Science, History and Geography are verified at strand level and, where cited, overall-expectation level; their specific codes were not checked one by one.

For teachers: the Ministry's curriculum is at **dcp.edu.gov.on.ca**. The companion **Grade 7 Mathematics** book cites all 52 codes individually; the **Everything Else** book carries its own verification page.