



This is all you need for this activity.

# Once upon a time there was a pterodactyl...

Adapting the steps of the scientific method can help students write about science in a vivid and creative way.

By Lauren Burrow

Today, scientists need more than top-class research skills. They need to have good writing and communication skills too: after all, what good is a discovery if you can't communicate it to others? One way to develop this skill is to adapt the long-established scientific method to encourage excellence in writing creatively about science.

Just like writing, the scientific method starts with an idea and ends with a publication. The basic idea of writing creative non-fiction is storytelling: finding a narrative way to share factually accurate scientific

knowledge in a captivating and vivid manner. For example, if the class has been studying the oceans' dead zones, students could tell the story of how a particular animal's survival, a sea turtle for instance, is affected, and write from the animal's point of view. This approach can help younger students to understand science and gives older students the chance to explain their scientific knowledge to others – all while nurturing the creativity that's essential for a successful scientist.

To see how the writing process can replicate the step-by-step process that scientists use in their normal work, let's look first at the two processes side by side, and then at the writing process in more detail.



- ✓ All sciences
- ✓ Ages <11–16

This article promotes interesting ways of encouraging students to communicate science more creatively. This type of writing or communication may go some way to supplementing public understanding of science, and the approach is worth trialling in all junior science classrooms.

All science teachers could benefit from trying these ideas at some stage, as they may help them make science more accessible to a wider range of students. This activity is applicable to all general science topics, although perhaps less so to those that are more mathematical.

*Marie Walsh, Ireland*

REVIEW

General science

Primary

Scientific process	Writing process
Define the question that you want to answer.	Idea development: choose the topic that you want to write about.
Construct the hypothesis that you will test.	Drafting: select a specific angle or point of view that you'll follow to write about your chosen topic.
Design the right experiment to test your hypothesis, and run it.	Writing: write the piece based on the draft, reviewing and adding material where needed.
Analyse your results, and deduce whether you need more or different experiments.	Revising: ask other people to read and comment on your text, then amend it.
Discuss your results with your peers and ask for input to make the results more meaningful and valuable.	Proofreading: check the text in detail.
Publish your results to share them with the scientific community.	Publishing: finalise your text and share it with your chosen audience.

## Material

You just need pens and paper.

## Procedure

### 1. Idea development

The first step is for students to come up with their own ideas and begin to organise them to use as a basis for their writing. Two exercises – ‘popcorn’ and ‘power writing’ – are good ways to get started as they help students to quickly pick research topics, review previously studied topics and expand their understanding.

**Popcorn:** Students brainstorm as a class about a particular science topic while the teacher lists everything that ‘pops’ up, perhaps on a big sheet of paper. The teacher can help students to categorise the list by colour-coding individual comments with highlighter

**Figure 1:** This diagram shows the collaborative ‘popcorn’ writing activity completed by students (aged 6–7 from Tennessee, USA) using the web-based program *Popplet*.

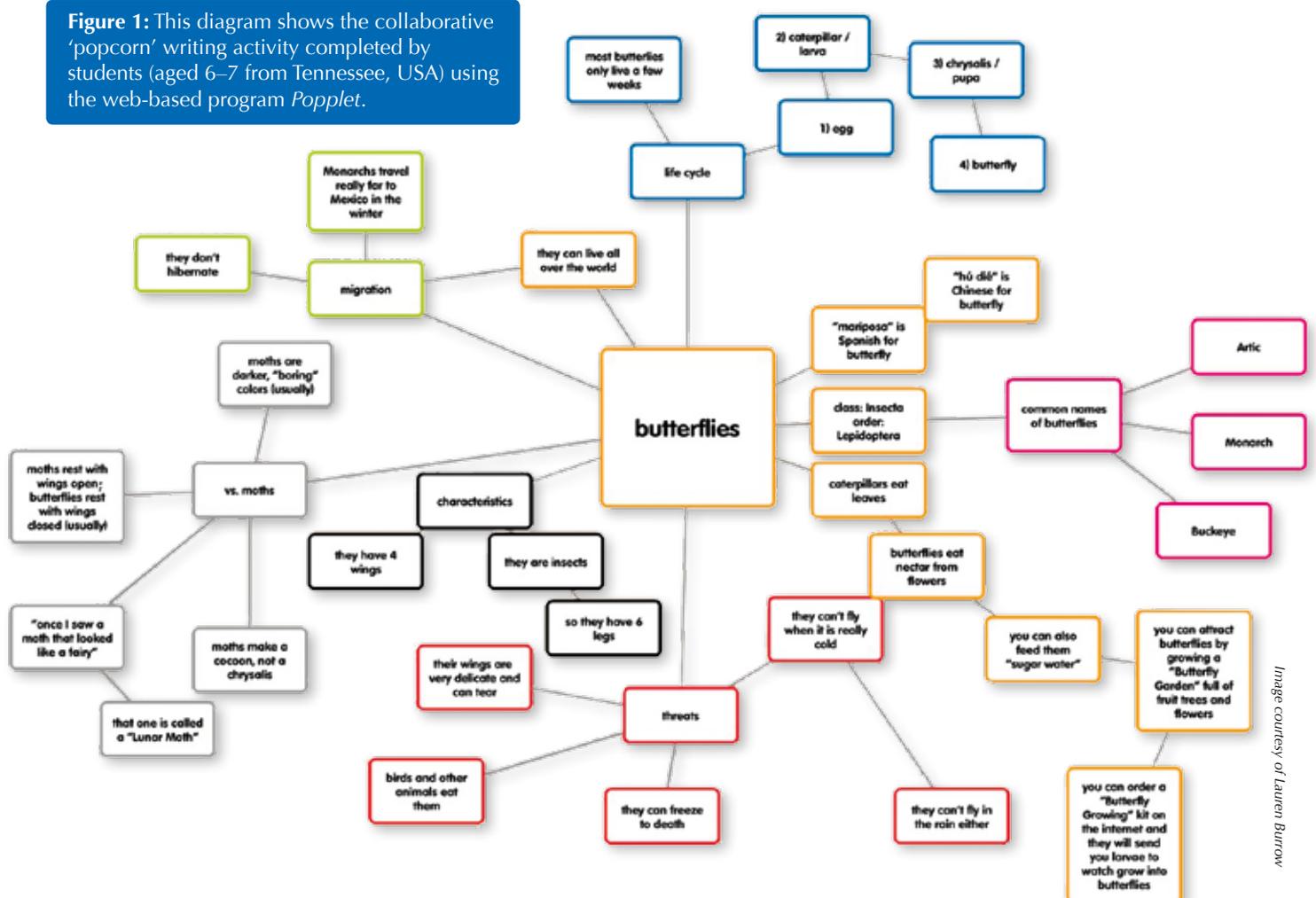


Image courtesy of Lauren Burrow

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Presenting their creative story in front of the class is rewarding for pupils.

verify these later on. Written prompts are also useful; for example, 'Describe what the animal *looks* like...', or 'What does this topic *remind* you of in your life?'.

## 2. Drafting

Before they start on their writing, students should choose a point of view from which to discuss the scientific topic – in the same way as they select a hypothesis to test when doing science. For example, they could look at the water cycle from the point of view of a water droplet or a cloud. Students should not create fictitious characters or situations, but use their understanding of science to express information in a captivating way.

Students should then start drafting by creating an outline. They can do this using their own 'power writing' efforts, adding numbers or arrows to pull the information into a coherent order and crossing out anything that doesn't relate to their intended science story. At this stage the students can also do another round of power writing on their chosen topic. Another method is the 'round robin' activity. Either way, allow time for students to say their story outlines out loud and get feedback from their teacher and other students.

**Round robin:** As a class, students take turns to tell the story from the viewpoint of the chosen character (e.g. a water droplet in our example of the water cycle). Each student should provide only one sentence of the story, with each sentence recorded on a strip of paper. At the end, students physically rearrange or remove the strips to produce a logically ordered story.

pens. Older students can use web-based programmes like *Popplet*<sup>vi</sup> to create digital concept maps collaboratively, with or without the teacher (figure 1).

**Power writing:** This activity uses the class discussion points from 'popcorn' as prompts. It should be a sustained, uninterrupted 5–15 minutes (depending on ages and abilities) in which students rush to

add as many factual details as they can to the existing writing (figure 2). Students can use illustrations, statements, phrases or even concept maps to help them further develop their own understanding. If students are hesitant, teachers should remind them that there are no wrong answers at this point: the activity is just about expressing their thoughts, feelings and ideas, and they'll have a chance to

Figure 2: An 8-year-old student's 'power writing' response to the topic of dinosaurs

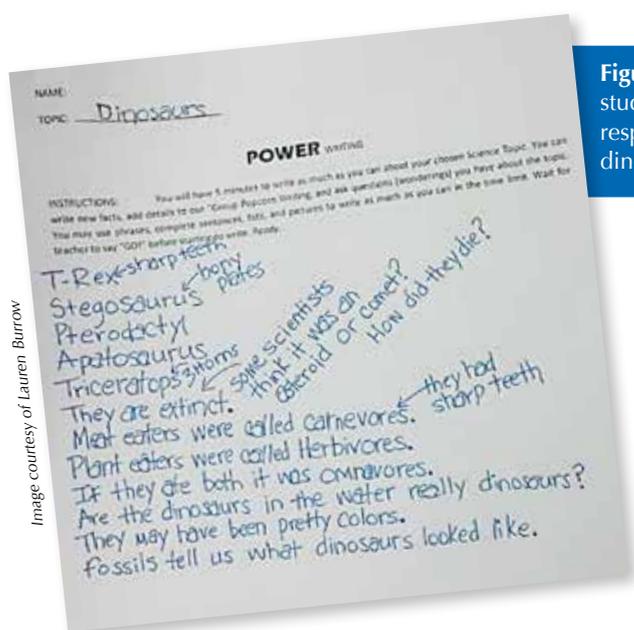


Image courtesy of Lauren Burrow



The traditional steps of the writing process. The doubling-back arrows indicate the optimal recursive process that students should undertake to ensure best writing. Adapted from Blasingame & Bushman (2005)

### 3. Writing

As students begin to write their stories, encourage them to use all their senses – just as they might when making observations in an experiment. This will produce a richly descriptive text, which they can then revise and edit. To promote this kind of sensory-based writing, try the ‘convince me’ exercise, to reactivate your students’ creative writing while remaining scientifically accurate.

**Convince me:** In pairs or as a class, students have to convince another student or the teacher that it is raining, snowing, night time, and so on, without using the topic word in their description. This can be done verbally or in writing (figure 3).

### 4. Revising

The revision step is often the one students dislike most, so encourage them to see this as an opportunity to pep up their writing and to make it really active and exciting. You can make the task more manageable by asking students to rewrite just small sections of their work, or of each other’s work. A good way to do this is using the ‘explode the moment’ trick developed by creative writing instructor Barry Lane (Lane, 1993).

Image courtesy of Lauren Burrow

**Convince me that it is snowing...**

**Directions:** Convince me that it is snowing without using the word “snow” in your writing. Use your senses to describe it so well that your audience will know that it is snowing without you ever using the word “snow” in your writing. When you are done, read aloud your writing and have a friend try to guess your word.

I step outside and the brisk, frigid air hits my face and my cheeks turn red as I feel the “cool burn” set in. I tie my scarf tighter and pull my woolen cap down over my ears, but it is no use because the tiny flakes of soft ice find their way through the cracks and chill me to the bone. I look up and the sky is dropping tiny, white specks at a steady, but lackadaisical pace. The tiny, white fluffs float to the ground and gather and accumulate into soft, pillowy mounds on the sidewalk and spill over to blanket the streets. I can hear the crunch of breaking ice under my thick boots as I trudge back up my driveway through the sea of cold, peaceful white fluff. I guess there will be no school for me today!

**Figure 3:** A 10-year-old student’s ‘Convince me’ response to the prompt: “convince me it is snowing without using the word snow.”

Image courtesy of Lauren Burrow

**EXPLAIN the water cycle in 6-WORDS...**

**Directions:** The water cycle is an intricate system in which all Earth’s water continuously moves between land, bodies of water, and the atmosphere. There are numerous vocabulary terms and concepts associated with the cycle that help explain it. Take what you know about the water cycle and condense it down into a 6-word explanation that summarizes the main ideas about the water cycle.

**Student examples:**

1. water evaporates, clouds accumulate, rain falls
2. evaporation, condensation, precipitation, collection, and again
3. into air, into clouds, onto ground, back around

**Figure 5:** These are examples of students’ (aged 11 from Texas, USA) six-word explanations of the water cycle.

**Figure 4:** An example of the ‘explode the moment’ exercise in which each student takes turns making a sentence bigger and better by adding another detail or clarification

**Starter sentence:** A spider.

**Bigger and Better!** A spider has eight legs.

**Bigger and Better!** An arachnid has eight legs.

**Bigger and Better!** An arachnid has four pairs of jointed legs.

**Bigger and Better!** An arachnid has four pairs of jointed legs with claws at the end of each leg.

**Bigger and Better!** An arachnid has four pairs of jointed legs with claws at the end of each leg that they can use to hold webs with.

**Bigger and Better!** An arachnid has four pairs of jointed legs with claws at the end of each leg that web-building spiders can use to build webs with.

Image courtesy of Lauren Burrow

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Working in small groups can boost each other's imagination

**Explode the moment:** After students have written a rough draft of their stories, they identify the most important action part of their text and mark it with a firecracker symbol. Then, they 'explode' just that moment of the story, rewriting it and adding new details that will make it really stand out (figure 4).

Revision is not only about adding; sometimes, eliminating the writing that they have worked so hard on can be even more difficult. The fun of physically cutting out text with scissors can encourage students to get rid of repetitive or irrelevant information. You can help wordier students to master the art of succinct writing by practicing 'six-word stories', in which they have to summarise an idea in six or fewer words (figure 5). Teaching verbose students to be more conscious of their word choices can lead to critical writers who understand the importance of writing clearly and concisely.

### 5. Proofreading

Students often find proofreading discouraging, seeing it as the teacher's chance to rip apart their ideas and highlight all of their writing errors. However, just like in science, where a hypothesis that turns out to be false is not a failure, proofreading gives students the power to identify their mistakes and to learn from them. To jumpstart the process, teachers can point out a few errors that students often make and then provide them with a simple proofreading checklist to allow them to correct the rest of their work. Explaining that the rules of grammar exist to give writers flexibility and variety of expression (Lane, 2008) may help to change students' negative perceptions of grammar.

### 6. Publishing

The most important step of any writing process is the last one: making sure the completed work is shared with others and celebrated. Today there is a plethora of publishing outlets through which students can share their science stories with peers, family and the world – whether with traditional methods or technology-enhanced techniques. Traditional in-class storytelling can promote public-speaking skills in front of a peer audience, while publishing with easy-to-use digital storytelling software can provide experiences that really motivate students during the publication phase.

In the end, not only will the scientists-to-be in your classroom have produced a piece of writing of which they can be truly proud, but they should be well on their way to developing a flexible and creative

Image courtesy of Erica Szlosek, US Fish and Wildlife Service; image source: Wikimedia Commons



Concentrating to find the right term

script for a play about how water is critical to the development of a new town, see: <http://water.usgs.gov/edu/dryville.html>

For more information on 'six-word stories', see: [www.sixwordmemoirs.com/](http://www.sixwordmemoirs.com/)

For a traditionally written example of a creative non-fiction piece about the water cycle, as told from the point of view of a drop of water, see: <http://water.usgs.gov/edu/followadrip.html>

For more information on digital storytelling, see: <http://digitalstorytelling.coe.uh.edu/>

The free SAS Writing Navigator provides guidance and support for students throughout the writing process: [www.sascurriculumpathways.com/portal/#/writingnavigator](http://www.sascurriculumpathways.com/portal/#/writingnavigator)

writing style. This will be a real asset to them later on, when they need to appeal not only to other scientists but also other science VIPs: investors, decision-makers or even the media.

## References

- Blasingame J, Bushman JH (2005) *Teaching Writing in Middle and Secondary Schools*. Upper Saddle River, NJ, USA: Pearson. ISBN: 9780130981639
- Lane B (1993) *After 'The End': Teaching and learning creative revision*. Portsmouth, NH, USA: Heinemann. ISBN: 9780435087142
- Lane B (2008) *But how do you teach writing? A simple guide for all teachers*. New York, NY, USA: Scholastic. ISBN: 9780545021180

## Web reference

w1 – For more information on the web- and iPad-based programme *Popplet*, see: <http://popplet.com>

## Resources

- For more examples of and resources on creative non-fiction, refer to: <http://creativenonfiction.org>
- For a digital version of the 'round robin' activity in which a class of second-grade students in Sydney, Australia, interpreted the water cycle from the point of view of a water droplet, see: <http://water.usgs.gov/edu/watercycle2ndgrade.html>
- For a longer, more formal example of a round robin activity, in which a teacher in Wisconsin, USA, adapted a creative non-fiction story into a

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