Telling a different story – research into the use of science stories

Richard Brock, Ben Rogers and **Liam Cini O'Dwyer** introduce their research into using science stories

Many science teachers enjoy adding interesting and entertaining stories from the history of science or cutting-edge research to their lessons. However, there is currently limited evidence on whether this practice is beneficial or research into the most effective way to use stories in lessons (Hobbs and Davis, 2013). In this article we introduce our research project, which hopes to provide guidance on how to use stories as part of classroom explanations and we consider the potential value or harms of storytelling.

Schmidt's camera

Despite losing his right hand in a childhood misadventure with a pipe bomb, Bernhard Schmidt became a lens grinder of considerable skill, producing telescope lenses for some of the leading astronomers in the early 20th century. To test his lenses, he set up artificial stars by hanging silver balls from trees and illuminating them with a spotlight. Schmidt would go on to develop a telescope, the Schmidt camera, which includes a lens that corrects the limitations of the spherical mirrors widely used in telescopes. The lens is currently being used in the Kepler space telescope.

The potential benefits and harms of stories

The story of Schmidt's career is one form of non-core-curricular elements that we will refer to as stories. Stories used in science classrooms might be categorised into at least three types: reports from the history of science (as in the Schmidt story); descriptions of contemporary science (for example, discussion of the discovery of the Higgs boson); and elaborations or asides about core curriculum knowledge (as in the case of discussing electric eels when teaching current).

Stories have been claimed to have several benefits for science teaching (Hobbs and Davis, 2013). First, stories may increase motivation to engage with scientific concepts – some students can find scientific knowledge somewhat removed from their everyday experience and lacking in the kind of human interest that makes the humanities interesting. Research suggests that narrative texts are more engaging than other forms of writing (Graesser, Singer and Trabasso, 1994). Second, teaching about the history of science can engage students with the processes of science and help them to understand the challenges of knowledge generation. In contrast with the image that might be inferred from the scientists referred to in the curriculum, discussing the biographies of a wider range of scientists can present a broad model of who can do science. Third, researchers have suggested that humans have a predisposition for processing information in the form of stories compared with other forms of information (Haidt, 2012). The events in stories are linked by cause-and-effect chains, which can aid recall and retention.

On the other side of the balance sheet, introducing stories can have undesirable consequences for science teaching. Stories can attract students' attention away from the substantive target knowledge of lessons – that is, they can act as 'seductive details' (Harp and Mayer, 1998). Inserting interesting but unnecessary details in explanations might result in students missing key content and failing to retain scientific knowledge. The use of stories is potentially problematic, as little of the target knowledge of science curricula is of a narrative form. For example, if Schmidt's story were inserted in a lesson about lenses, students might remember Schmidt, and his childhood experimentation with explosives, but not the subsequent definition of convex and concave lenses.

Evidence from a study of university students reading scientific texts, with and without seductive details, found that the inclusion of interesting but irrelevant asides reduced learning of the intended content (Harp and Mayer, 1998). The researchers who conducted the study hypothesised that the detriment to learning happened not because of distraction, but because the seductive details primed irrelevant knowledge structures (for example, the Schmidt example may bring to mind schemata related to bombs or injuries) leading to the target knowledge being embedded in cognitive structure in a way that is hard to recall. Stories add additional cognitive load, and it may be challenging for students to separate the signal (the target concept) from the noise (the motivating, but tangential stories). The contrast between an engaging story and the abstract nature of some scientific knowledge might prompt disengagement.

Finally, stories may present an unrealistic model of the nature of scientific work. Stories, like the Schmidt example above, are chosen for their dramatic or emotive content; they may present an overly romanticised model of scientific work. As an alternative, teachers might include stories that highlight the painstaking and unglamorous work of scientists, such as the story of the synthesis of mendelevium, the first element

to be synthesised one atom at a time. A team at the University of California, Berkeley bombarded a target of einsteinium with alpha particles to produce just 17 atoms of mendelevium. The stories teachers tell about science present a model of the nature of the discipline, and care needs to be taken over their selection.

Using stories in science teaching

Science teachers currently lack guidance as to whether stories should be included in lessons and, if they are to be included, how to use them to support learning and motivation. In our experience of observing lessons, teachers sometimes insert stories into explanatory sections of teaching. For example, stories of Newton's life might be included in explanations of his laws. Embedding stories in explanations may draw attention away from the target knowledge or overload working memory. Alternatively, stories might be reserved for the starts and ends of explanatory sections or for distinct periods of teaching focusing on the history of science.

Since starting the stories project, we have received reports of several different ways stories have been used in science departments. These include:

- as literacy activities that promote engagement with texts (see those on Ben Wilkinson's website below);
- to create displays that highlight the lives of scientists and so broaden images of who can do science;
- by recording audio versions of stories.

The stories research project

We are investigating different approaches to inserting stories into explanations. We are fortunate to have received funding for our research from the Institute of Physics and we are grateful for their support and championing of the stories project. The study adopts a quasi-experimental design based around a survey. Participants watch two video explanations, of lightning and of white dwarf stars, and are randomised to see a version of a video with stories inserted or without (Figure 1). Participants are given a knowledge test before and after watching the video.

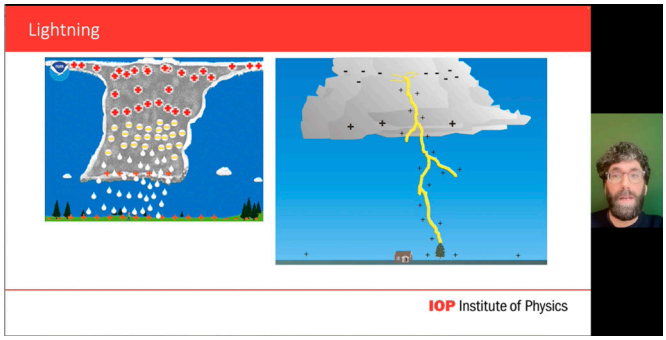

Figure 1 A still image from the research tool – an explanation of lightning

The survey is open to students over the age of 16 studying any subject. If you are interested in your students participating, please share the URL or QR code below with them. The links take them to our survey, which starts with an information sheet describing the project. The survey ends with an option to take part in a delayed post-test, which checks whether knowledge taught in the video is retained. If they consent, students will be emailed a link, two weeks after completing the survey, to a third knowledge test. Participants can also choose to take part in an interview in which they watch a video and 'think aloud', verbalising how their attention shifts during the explanation.

Conclusion

We have enjoyed using stories about science in our teaching but are curious about the impact they have on students' attitudes to science, their motivation and their learning. We hope our survey can shed some light on different approaches to embedding stories in science lessons.

Useful links

Booklets of physics stories can be found on the IOP Spark website: https://spark.iop.org/stories-physics

A collection of story-based comprehension worksheets curated by Ben Wilkinson: https://drwilkinsonscience.wordpress.com/2018/07/05/sciencestories

References

Graesser, A. C., Singer, M. and Trabasso, T. (1994) Constructing inferences during narrative text comprehension. *Psychological Review*, **101**(3), 371–395.

Haidt, J. (2012) *The Righteous Mind. Why Good People are Divided by Politics and Religion*. London: Penguin.

Harp, S. F. and Mayer, R. E. (1998) How seductive details do their damage: a theory of cognitive interest in science learning. *Journal of Educational Psychology*, **90**, 414–434.

Hobbs, L. and Davis, R. (2013) Narrative pedagogies in science, mathematics and technology. *Research in Science Education*, **43**(3), 1289–1305.

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Stories Research Survey
https://qualtrics.kcl.ac.uk/jfe/form/SV_etx5tah3P4dp2uy