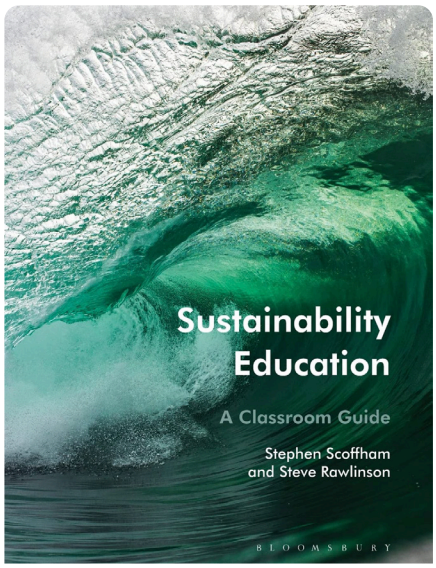
Reviews

Reviews published in *School Science Review* are the opinions of individual reviewers, and are not an official Association for Science Education (ASE) view or endorsement of the resource. Reviewers are selected to write reviews on the basis of their experience and interests. They are expected to draw attention to perceived weaknesses or limitations of a resource as well as its strengths. The reviews are written from the standpoint of someone seeing the materials for the first time and considering how they themselves would use them, or think colleagues would be likely to use them.



Sustainability Education: A Classroom Guide

Stephen Scoffham and Steve Rawlinson
London: Bloomsbury, 2022
277 pp. £19.99
ISBN 978 1 3502 6207 2

This excellent book should be essential reading for all primary, middle and preparatory school head teachers and policy makers, especially at the Department for Education. Defining sustainability as '*living within our means*', the authors (ex-Presidents of the UK Geographical Association) state that sustainability is a multifaceted challenge requiring multiple solutions, as well as a wholesale shift as society transitions to a more sustainable existence. The ideas underpinning sustainability have to start at school.

The authors argue that sustainability should be at the core of the modern curriculum, fitting well into Bruner's spiral curriculum, and providing the framework supporting the rest of the curriculum. The book is divided into four main sections: *Exploring sustainability*; *Sustainability education*; *Areas of study and implementation*; and *Designing a sustainability curriculum*.

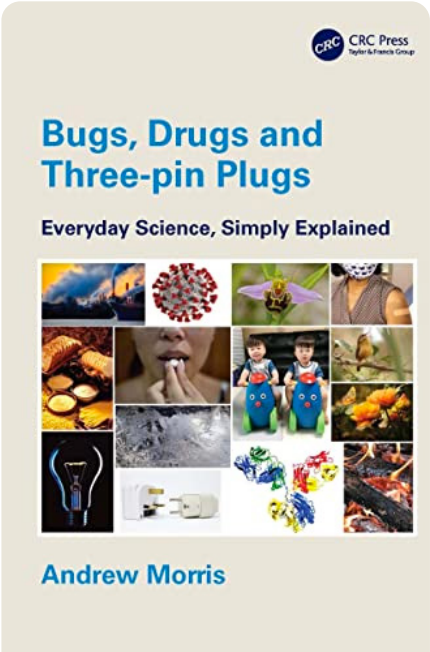
The *Areas of study* include many topics that will be familiar to teachers already but some that may be new: *Earth in space*; *Life on land*; *A watery planet*; *Weather and climate*; *Food and farming*; *Jobs, transport and energy*; *The global village*; *Special places*; *Citizenship and democracy*; *Pollution and resources*; *Unequal world*; and *Sustainable living*. In *Food and farming,* for example, the section for ages 3–7 covers topics such as *Five a day*, *Bugs are our friends*, *Growing marigolds* and *Making a wormery* as well as ideas for *Investigation and fieldwork*. Choosing *Life on land* as another example, the section on *Reconnecting with nature* (for ages 7–14) has teaching ideas that include *Wildlife at risk*, *The food web*, *Famous conservationists* and, again, suggestions for *Investigation and fieldwork*.

There is a glossary of some of the main concepts, as well as tables for learning opportunities for ages 3–7, 5–11 and 7–14. Eight helpful case studies of sustainability education in action from schools around the world are included.

These range from *Outdoor learning* in Australia and *Forest schools* in the UK; the *Role of an eco committee* (including recycling; innovative bake sales; encouraging a love of nature through reading, drawing and writing; and running a repair club) through to *The Harmony Project,* which puts natural principles such as cycles, diversity and interdependence at the heart of education. The book's companion website contains additional details of supporting resources.

Society's future is full of challenges for all educators but this first-class book provides plenty of ideas as to how we can be optimistic about the future.

Gordon Miller



Bugs, Drugs and Three-pin Plugs: Everyday Science, Simply Explained

Andrew Morris
London: CRC Press, 2022
212 pp. £14.99
ISBN 978 103222492 3

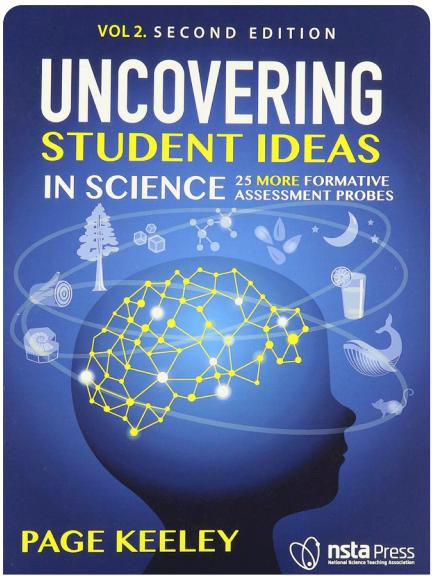
This is an unusual book – and therein lie its strengths and one or two limitations. Its purpose is clear from the subtitle, and the topics '*simply explained*' include the way in which certain medications work, how migrating birds find their way, how white light is composed, the basis of familial resemblances, the water cycle, the molecular structure of ice – and ten more varied topics including some psychology and '*the basic science of the pandemic*'.

So far, not so unusual – but this book hasn't been written by someone sitting at a desk, trying to work out how to explain difficult concepts simply. It arises from '*live discussions with adults from all walks of life*' over a considerable period of years. The result is a text with a conversational style, sometimes addressing the reader as 'you', but occasionally reverting to 'we' (which jars a bit). From time to time there are quotations from members of the discussion groups, which give the conversation life and authenticity – but there were times when I felt that the text reads more like the script for a podcast than something intended for the printed page.

That said, the explanations are for the most part clear and engaging, and although this is not a book you sit down to read at a single sitting, it is a conversation you are warmly invited to join. It is a very good conversation, the tone and the level are well judged, and the explanations – in most cases – are sound. There's a misleading lapse at the very start, however, where – in reference to Figure 1.1, the graphic formula of caffeine – it is claimed that '*the length of the lines and the angles between them correspond to the exact distances and angles between atoms*'. Although, unusually, there is some attempt at scaling in this particular diagram, such formulae are two-dimensional representations of a three-dimensional structure, schematically drawn according to printers' conventions.

In reviewing this book for *SSR,* I am left with the question of 'audience'. I sense that it is more likely to be picked up and read with enjoyment by a student with the U3A than by one from U6Sci. It is a book by adults for adults – not because there is anything 'adult' about the content, but because of its style. Teachers would do well to sit down with a copy, however, and to reflect on their own 'explanatory conversations' in the classroom.

Colin H. Johnson



Uncovering Student Ideas in Science, Vol. 2: 25 More Formative Assessment Probes 2nd edn.

Page Keeley
Arlington, VA: NSTA Press, 2021
200 pp. £37.95
ISBN 978 1 68140 832 3

Page Keeley's latest book in her *Uncovering Student Ideas* series updates a previous collection of short tasks, called probes. These are presented in different ways but they commonly require students to do one of three things: identify the correct response to a situation (as in concept cartoons), tick all the applicable options in a list or identify which of the offered statements is/are true. Importantly, students are then required to justify their answers.

The second edition of this 2007 book adds recent research summaries and a Spanish version for each of the 25 probes. There are also links to related disciplinary core ideas in the K–12 Science

Framework (2012) and to the Next Generation Science Standards (2013) but these will be of more interest to US readers than those based in UK schools.

Although the probes are deliberately ungraded, most seem to align with the UK's key stage 3 curriculum (ages 11–14). A few, such as the two probes for rocks, could suit younger ages whereas *Food for plants* might well trip up older students who don't read the question carefully!

Despite the book's '*uncovering*' label, the probes are designed to be used formatively rather than diagnostically and guidance for making this important step is provided in each case. Keeley rightly reminds us that '*knowing the ideas that students bring to their learning is not the primary goal … a teacher needs to think about how to choose or modify a lesson or activity to best address the ideas students bring to their learning*'. With that in mind, I suggest that 'developing' might be a more appropriate verb for the book's title.

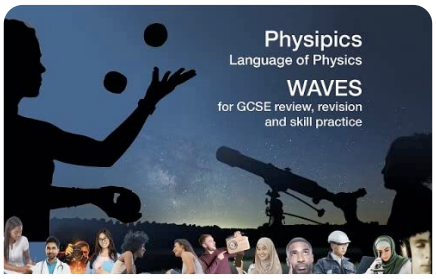
I found some of the probes a little repetitive; the two probes about rocks, mentioned above, are variations on the same theme and a similar situation prevails for both density and boiling. But there is no harm in reinforcing the correct knowledge because, as Keeley says, '*alternative science ideas that go unchallenged will often follow students from one grade to the next, and even into adulthood*'.

The research and references are also repetitive but this can be justified in the interest of keeping each probe self-contained. My most serious gripe, however, is the book's binding. After nothing more than flipping through for review purposes, without flattening the book on a photocopier to make class sets, pages were already starting to drop out. By the end of my review I had eight loose sheets of paper and two more pages that were just hanging on. A spiral-bound design would surely have been much more durable.

It is worth adding that copying to produce class sets is permitted only for purchasers to use in their own classrooms. If the e-book is bought then its contents can be downloaded to multiple personal devices but resources cannot be passed to non-buyers. These restraints are reasonable but they will make the resources expensive for whole-department use in a law-abiding community. [When budgets are limited, an alternative would be to explore the free-to-use MOSART resources, mentioned in *Science websearch* on page 44 of *SSR in Depth*, **104**(386).]

More information and sample resources from Page Keeley's 12-volume *Uncovering Student Ideas* series, which has books devoted to both primary and secondary science as well as mathematics and astronomy, can be found online at: www.uncoveringstudentideas.org.

Jon Tarrant



Physipics, Language of Physics: Waves for GCSE review, revision and skill practice

David Brodie
Shrewsbury: Smilite, 2022
86 pp. £7.95
ISBN 978 1 7396515 0 3

This review, revision and skill workout booklet is quite unique in its use of annotated colour images and photographs. The target audience is GCSE physics students to use alongside their physics course to prepare for their exams and it is a handy size to use (A5 spiral bound).

The book is organised into 14 chapters, each focusing on a different section of the 'Waves' topic. The Physipics Frame pages use photographs to describe and explain the concepts and the colour-coded blob-like creatures that overlay the photographs help guide students through the theory. The photographs add context so that students can see how the theory explains everyday phenomena. At the end of each chapter there is a practice section with puzzles and label challenges to test students' recall.

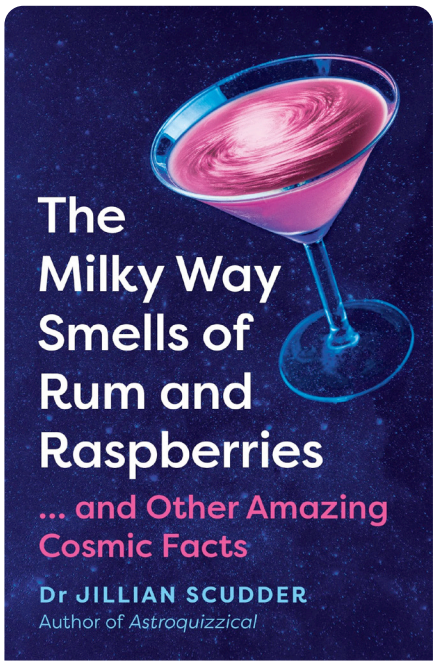
Presenting the information in such a colourful way is new. I particularly liked physipics W1d showing the wavelength and amplitude of ocean waves. It can be challenging for students to apply the wave diagram to physical waves so the labelling of an ocean wave with terms such as crest and trough is helpful. The photograph in the background of physipics W6d, on measuring distance with sonar, is a good use of the image to deal with the common errors that students make when calculating the depth of water. The puzzles add an element of fun and challenge to each topic by getting students to use the information on the frame pages. Rather than including the answers in the book (so no temptation to cheat!), hints are provided online at www.physipics.com. The website also contains grids that map the exam board specifications with the pages in the physipics book.

It would be helpful to have a list of chapters at the front of the book with an explanation of the frame page numbering to make it easier to find the topic that students want to focus on. Personally, I found the combination of text over the photographs to be information overload for the majority of the physipics frames, as well as making it difficult to know where to start reading. The images are useful

but when presented in this way, with different coloured text, my concern is that students will find the amount of information on each A5 page overwhelming. Indeed, the students I asked to have a look at the guide also felt that the photographs were useful but made it difficult to read the key points, as well as making it more difficult for students with SEN needs to process the information.

Overall, it is an interesting addition to the market, giving a new twist to revision materials, with good examples and revision activities for students to do, but the format may not be to everyone's taste.

Gill Clarke



The Milky Way Smells of Rum and Raspberries … and Other Amazing Cosmic Facts

Jillian Scudder
London: Icon Books, 2022
239 pp. £12.99
ISBN 978 1 78578 926 7

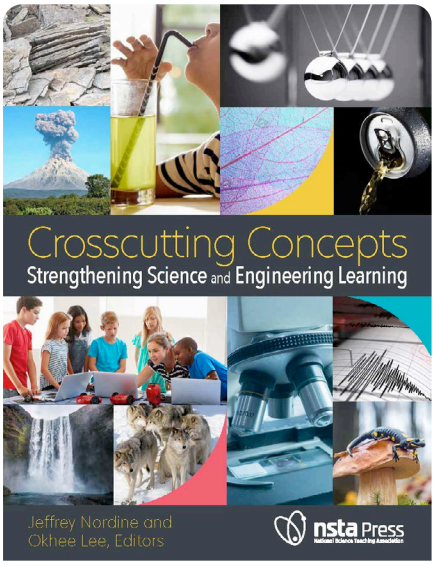
If you want bizarre sound bites about the universe then this is the book for you. Unashamedly nerdy, each of the 34 chapters is between 4 and 6 pages long and has an intriguing title, such as '*The universe is beige on average*' and '*It rains diamonds on Neptune*'. These draw you in to finding out more about a range of astrophysics topics.

The author is an astrophysicist and Associate Professor of Physics and Astronomy and this is her second book aimed at the general reader. It can help the reader see how astrophysics research has broadened our understanding of the universe and, for those wanting to know more, there are notes identifying where the information came from. These sources are not new and vary from research papers to the *Guinness Book of Records*.

The title refers to an essay about the Sagittarius B2 gas cloud, which discusses the chemical compounds found there. It begins with how the central black hole and gas clouds are named before discussing the density of gases, which gases are there, and how – from 25 000 light years away – scientists identified compounds such as the ethanol and ethyl formate found in rum and raspberries.

This book is for dipping into when the mood takes you rather than reading from cover to cover. For teachers, it could be used to provide anecdotes and add interest to lessons. It is also suitable for older pupils where it may just ignite a spark to continue with physics at A-level and beyond.

Sarah Wood



Crosscutting Concepts: Strengthening Science and Engineering Learning

Ed. Jeffrey Nordine and Okhee Lee
Arlington, VA: NSTA Press, 2021
508 pp. £59.80
ISBN 978 1 68140 728 9

When American science education makes the news, it is usually because of strongly held views that do not have much place in classrooms in the UK, but the world's largest economy cannot function without a scientifically literate population. In 2011, a consortium of 26 states and national organisations for the promotion of science understanding collaborated to produce the Next Generation Science Standards (NGSS). This is a collection of standards for content and practice, coupled with performance expectations for assessment organised to provide a coherent programme of study from kindergarten to the final year of high school.

The programme has three strands: *Disciplinary Core Ideas* (DCI), the body of knowledge that students should learn, *Science and Engineering Practices* (SEP), the skills and techniques for science, and *Cross Cutting Concepts* (CCC) – ways of science thinking that are common to all science and engineering endeavours, a method to make scientific sense of new observations.

Cross Cutting Concepts was a new idea for the NGSS and embodies the biggest difference between USA and UK science education. Adoption in the US has not been easy and this book attempts to improve teachers' confidence with this aspect of science education. The framework's crosscutting concepts are: *Patterns*; *Cause and effect –mechanism and explanation*; *Scale, proportion and quantity*; *System and system models*; *Energy and matter – flows, cycles and*

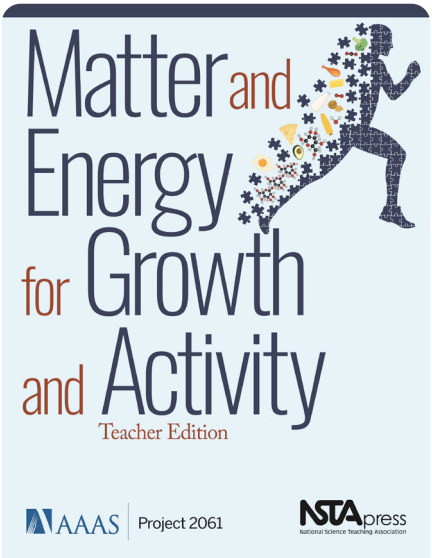
conservation; *Structure and function*; and *Stability and change*.

The book sets out each concept in detail, with each CCC having a chapter explaining what it means and giving practical examples of the use of the CCC in the science classroom across the wide age range covered by this science curriculum. The book advocates for explicit use of the CCCs in teaching, making links across subjects and to make scientific thinking clear.

The book suggests a radical change in assessment is needed to investigate student understanding of CCCs. Assessing CCCs is not a check on rote learning or even understanding of taught content. Instead, assessment of the CCCs tests how well students can apply the ideas to a problem or phenomenon they have never seen before: '*Ultimately, if we want students to be able to use science in their everyday lives, they must be able to use what they learn in school to explain and understand what they encounter outside of school*'.

Crosscutting Concepts: Strengthening Science and Engineering Learning proposes a new approach to school science for students who, by the equivalent of our secondary school age, typically spend an hour each day studying some sort of science in classes of 24.9, smaller than the UK average of 27.6 people. The USA's NGSS should be considered by any UK science educators with a hand in designing what our school students learn and how they learn it and by campaigners for curriculum reform. For ordinary classroom teachers, this vision of what could be will make the regular UK routine depressing or light a fire within to promote change.

Maria Kettle



Matter and Energy for Growth and Activity: Teacher Edition
National Science Teachers Association
Arlington, VA: NSTA Press, 2020
420 pp. £47.50
ISBN 978 1 68140 685 5

Matter and Energy for Growth and Activity: Student Edition
National Science Teachers Association
Arlington, VA: NSTA Press, 2020
200 pp. £28.63
ISBN 978 1 68140 686 2

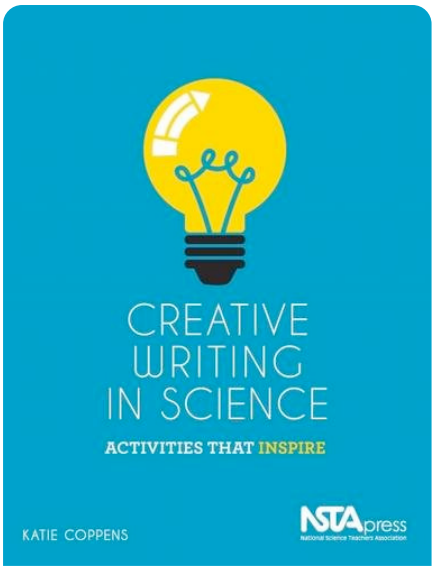
Aimed at grade 9–12 students in the USA (so GCSE and A-level students in the UK), these books provide 14 in-depth lessons that investigate the matter and energy changes involved in biochemical reactions like respiration. Students also learn how our bodies heal wounds, build stamina and why we need energy even when we are asleep or inactive.

These are well-produced books. Via the Teacher Edition there is access to a website, which provides links to videos and other resources. The Teacher Edition addresses common misconceptions (much in the way that Keith Taber does in his book *Chemical Misconceptions*) and the lessons confront these head-on.

However, these books are designed for the US market so the material they cover does not match the UK specifications. Though not an insurmountable problem, they also use Imperial units as opposed to SI units. It would be helpful if the Student Edition were loose-leaf, which would make worksheets easy to photocopy. It would be even better if the Student Edition were in electronic format so that material could be edited to suit the needs of individual classes or the preferences of teachers.

It would be challenging to exploit the full potential of the Student Edition without the Teacher Edition. As a pair, they are too expensive for a typical classroom teacher. However, it might be a worthwhile investment for a science department designing a bespoke course or looking for ideas for enrichment activities.

Mike Follows



Creative Writing in Science: Activities that Inspire
Katie Coppens
Arlington, VA: NSTA Press, 2016
140 pp. £27.95
ISBN 978 1 941316 35 1

If *Creative Writing in Science* went through a full localisation process for the UK market, I feel that this book could become a compulsory piece of literature within any science education PGCE or teacher-training course in the UK.

In recent times, the term STEM (science, technology, engineering and mathematics) has been

gradually evolving to incorporate 'art' into the terminology to become 'STEAM'. This is due to many STEM education policymakers and academics pushing for the de-siloing of the different curricula within STEM and allowing for further cross-curricular links with the added creativity that the arts and humanities can bring.

The author, Katie Coppens, clearly shows her experience as a language teacher, an arts teacher and, most importantly, as a science teacher. This book is less about the values of incorporating creative writing into science and more of a workbook that science teachers can draw from to incorporate more creative elements into their science lessons.

Katie Coppens uses a wide variety of creative techniques, ranging from letter writing to producing instruction manuals and even comic writing to cover a wide variety of biology, chemistry and physics topics for a surprisingly wide range of ages, encompassing most of the K–12 curriculum. Katie Coppens does not hold back in the amount of value this book holds for teachers. She includes links to how the activities can be used for what part of the K–12 curriculum, to scaffolded worksheets for students, and even grading rubrics to allow teachers to provide feedback and grades for these activities, which, on first glance, look like formative assessments but with some tweaking can easily become summative assessments.

This adherence to the American K–12 science curriculum makes this book an essential read for any American science teacher but due to the few overlaps between the American and UK science curricula, it unfortunately makes the book less valuable in the UK market. A good example is within her Appendix 1: *Connections to Common Core State Standards for writing and for speaking and listening*. These tables would be useful for a mid-term planning perspective and easily allow for cross-curricular planning, but because they are not relevant to the UK National Curriculum, this amazingly produced resource becomes somewhat redundant in the UK market.

Despite this book being centred on the American science curriculum, it still holds substantial value to teachers planning creative science lessons in the UK. One aspect of the book I adored is Katie's sense of humour and understanding of 'Gen Z' humour, which, unlike many other educational books that aim to be 'funny' for children, does not come off as 'cringe' but rather hilarious in a very subtle way, akin to a well-written children's cartoon like *Animaniacs*, *The Amazing World of Gumball* or *Regular Show*. Katie's example of a speed-dating session transcript between Sodium and Chlorine in Chapter 14 was both highly educational yet hilariously dark. Katie also has a clear understanding of how students react to certain topics and provides examples on how to mitigate immature humour within her activities in order to prevent diversions from the lesson plan. A good example of this is within Chapter 6's travel blog activity on a piece of food travelling through a human's digestive system, where she includes an entire paragraph on how to stop children from making jokes about the food reaching the rectum and what kind of responses she expects children to provide.

In conclusion, if *Creative Writing in Science* was provided with a full localisation to make it align with the UK's science curricula, it would be an essential piece of literature for every secondary school science department and teacher-training programme's reading list all over the country.

Francis Jones

Reviewers

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Colin H. Johnson is an honorary research fellow at Cardiff University.

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Maria Kettle worked as a physics teacher for 18 years and then 11½ years as the outreach officer at the Department of Engineering, University of Cambridge. Currently, she runs physicstube.org and edits book reviews for *SSR*.

Gordon Miller is a retired physics schoolmaster and university adviser who worked in several schools in the state and independent sectors, his final 27 years being at St Paul's School, London.

Jon Tarrant is a former Head of Sciences, now working as a freelance writer and photographer. He is the creator of physbang.com and the author of seven books on photography.

Sarah Wood is Head of Science at a small independent school in North London.