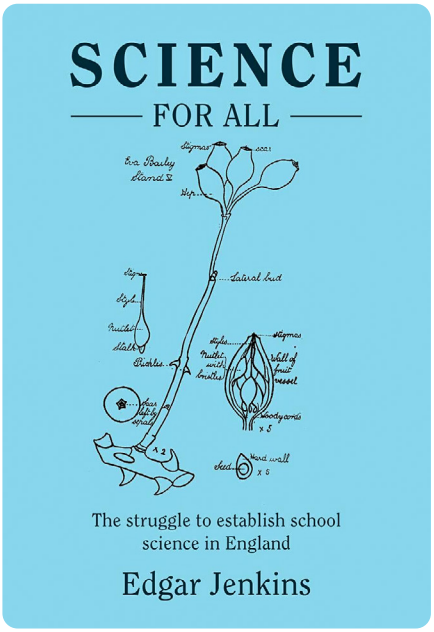
Reviews

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.



Science for All: The Struggle to Establish School Science in England

Edgar Jenkins
London: UCL Institute of Education Press, 2019
207 pp. £24.99
ISBN 978 1 78227 264 4

Be in no doubt: this is an important book. Please read on to understand why.

The place of science in the school curriculum is now secure. Today we have no doubt that science education is important to the future supply of scientists, engineers, doctors – and epidemiologists. We believe that the science that young people learn at school empowers them with the knowledge, skills and understanding that they can use in their future lives, and that democracy is best served by an informed populace. Moreover, a general appreciation of science gives our scientists a 'licence to practise' so that they may further the interests of the community at large. If we are science teachers we probably take these things for granted, but it was not always so. Science education today has many stakeholders, but – as Jenkins makes clear in this scholarly account – this position has been achieved slowly and along a tortuous path.

The coronavirus pandemic has led us to re-examine many of our assumptions about education – our priorities and our ways of working – but no one has questioned the primacy of science. Indeed, the UK Government has insisted that its decisions have at all times been '*led by the science*'. At a time of crisis there is an overwhelming pressure to respond to the demands of the here and now, but to put time aside for mature reflection remains very important. This is where this book comes in. Through its account of how science gradually found its place in school curricula, it sets the work of science teachers in its historical and cultural context.

As the author makes clear in his introduction, an appreciation of this background is not merely an academic study: it helps science teachers and those who train them to understand where we are now and '*provides a context within which to respond to further attempts at curriculum reform*'.

A short opening chapter on the 'Nineteenth Century Background' skilfully summarises the wider framework for what Jenkins calls '*the struggle to establish school science in England*'.

Ever since the middle of the 19th century there have been competing pressures on science

education from 'top down'/ academic to 'child-centred'/ practical. As early as 1853, the Committee of Council on Education was saying that science education's purpose was to develop '*the character of the maker in the child, as contrasted with the worker*'. Even before then, as the opening chapter on a 'false dawn' in elementary school science makes clear, there were people who had produced sophisticated science curricula with a focus on the subject as a discipline (Henslow) or as a practical study (Dawes).

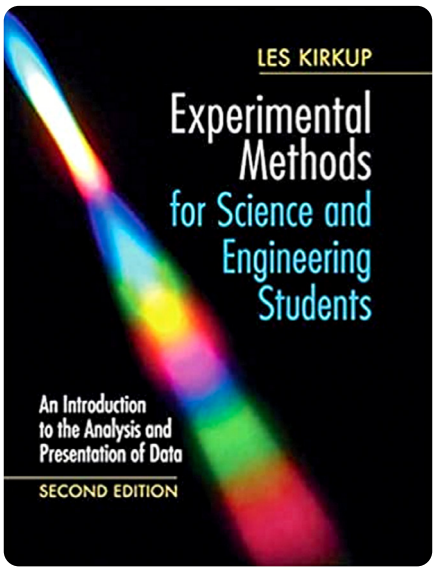
It is this engaging story that Jenkins develops with skill and authority through five further chapters: he deals separately with elementary and secondary schooling until the 1902 Act, which created local education authorities, followed by the period until the Butler Act of 1944 created the 'tripartite' system of grammar, secondary technical and secondary modern schools. Finally, he covers the years to 1989 (the National Curriculum) in which ASE and its predecessor organisations, the Nuffield Foundation, the Schools Council and a host of others, were concerned to define, refine and secure the position of what became known as 'science for all'.

The text is supported by around 250 references, conveniently gathered at the end so that they don't get in the way of the narrative. There is a sense in which this book runs both in parallel and in succession to the same author's early work, the widely praised *From Armstrong to Nuffield: Studies in Twentieth Century Science Education in England and Wales* (John Murray, 1979). If you take your science teaching seriously, you should have copies of both.

If there is a disappointment, it is only that the book had to be brought to a close in 1989. In Jenkins' view it is still too soon to attempt a history of how science in English schools has been affected by successive iterations of the National Curriculum. I would also have liked a few pictures!

This book could easily have been placed with an academic publisher that issues volumes priced at a three-figure sum, which only find their way on to library shelves. The author and publisher here are to be congratulated on producing a wholly serious, but unpretentious volume at an accessible price. No self-respecting science department should be without a copy!

Colin Johnson



Experimental Methods for Science and Engineering Students: An Introduction to the Analysis and Presentation of Data

2nd edn. Les Kirkup
Cambridge: Cambridge University Press, 2019
224 pp. £37.99
ISBN 978 1 108 41846 1

This book consists of nine chapters, starting with an introduction to experimentation and working through the characteristics of scientific data, graphical representation, analytical methods and report writing, and finishing with chapters on *Excel* and computer-aided data capture. At the end of the book there are two technical appendices, references and suggestions for further reading.

The book is well laid out and written in a very clear style with a substantial number of tables, diagrams and worked-calculation examples. Some chapters, where appropriate, have a set of problems for the reader to try, with solutions at the back of the book.

An early chapter deals comprehensively with how to represent data correctly in both linear and logarithmic graphical forms, covering everything from labelling axes to estimating uncertainty in gradients. This is followed up in a later chapter, which looks in more detail at the method of least squares applied to x–y linear data. The estimation of experimental uncertainty for single and repeat measurements and their analysis using simple statistics, such as standard error of the mean, are clearly explained. I have found that this is a topic students can initially have some difficulty with and I think the clear guidance of the author would make a difference to their understanding.

A chapter on report writing and presentation deals with all the aspects of good report writing and includes an exemplar report for the reader to critique. The chapter finishes with advice on oral presentations and the increasingly important use of posters in academic communication.

The penultimate chapter is devoted to the use of Microsoft *Excel* to present and analyse data, where the author covers some of the basics about data entry, manipulation and display. For someone who has never heard of a spreadsheet and what it can do, this might be useful; however, I have a couple of reservations. Firstly, any book that describes software can become rapidly out of date: I personally have five versions of *Excel* spread across my devices and actively use two of them. Admittedly, what the

author describes is fairly basic and gives a starting point. My second reservation is that there are a lot of good free training materials on the internet that will walk users through problems and do the job better than a book can.

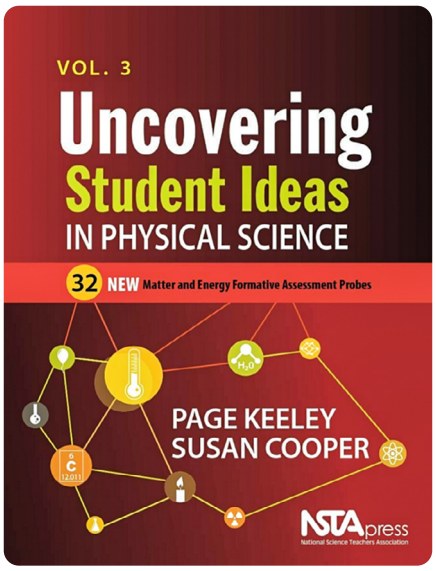
The final chapter is devoted to computer-aided data capture and explains the basic idea of analogue-to-digital conversion (ADC), which is the key step in converting the output of sensors into a form that can be manipulated by computer systems. The sections on signal conditioning (amplification in this case) and the resolution of ADC are interesting and would be useful to anyone buying data-acquisition equipment. The author concludes with a brief discussion of plug-and-play data acquisition and analysis systems and in particular mentions the very popular *Arduino* unit. Colleagues in UK schools and colleges will know that there are a range of alternative off-the-shelf datalogging solutions available, as well as similar things to *Arduino* such as *Raspberry Pi* or the neat little BBC *micro:bit*.

I found this an extremely useful book, which would be a great resource for all teachers. I think students studying for level 3 courses such as BTEC applied science and GCE A-level, and maybe the first year of a science-based degree, would find this a valuable aid to their experimental work.

Alex Chaplin

Uncovering Student Ideas in Physical Science Vol. 3

Page Keeley and Susan Cooper
Arlington, VA: NSTA Press, 2019
224 pp. £34.95
ISBN 978 1 68140 640 6



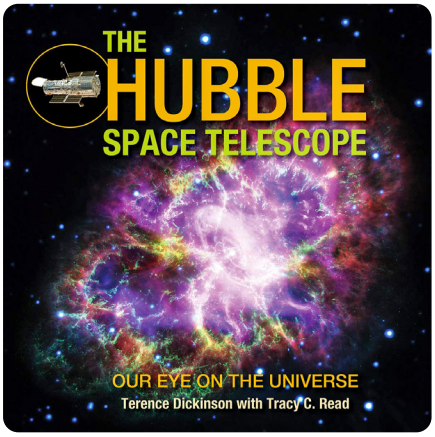
This book contains 32 concept cartoons designed to challenge common misconceptions of late KS2 and early KS3 pupils. This is the 11th book in a series called *Uncovering Student Ideas* and focuses on physical chemistry topics. The worksheets make good short starter activities. The National Science Teaching Association (NSTA), which could be described as ASE's American sister organisation, is, among other things, a prolific publisher of up-to-date science teaching books. If you have never read any NSTA books before, then this is a good one to start off with.

The teacher notes for each worksheet are a fully referenced and scholarly discussion of the educational research, ideal for less experienced teachers who want to get a better feel for common misconceptions that their pupils might have. Ros Driver (*Making Sense of Secondary Science*) and Vanessa Kind (*Beyond Appearances*) are frequently referenced. There is a focus on getting pupils to develop a deeper understanding of key concepts and fundamental ideas such as conservation of mass, properties of elements and compounds and chemical reactions. This emphasis on 'teaching for understanding' is one of the book's main strengths.

Although there are several 'concept matrix' tables to show how the worksheets correspond to the American science curriculum, there is nothing relating to UK curricula. Another 'Americanism' is that each worksheet is also translated into Spanish. Some of the concept cartoons seem a little too superficial: pupils just have to choose between two opposite options where one answer is right and the other wrong. For example, '*Lola says irradiated strawberries are safe to eat. Emmet says they are not. Who do you agree with?*'

Although the publishers are clearly aiming the book at classroom teachers, it comes across more like an academic science education book for someone doing an MA. What would be more useful for UK classroom teaching would be a publication containing all of the *Uncovering Student Ideas* worksheets (just the worksheets alone) divided up into three categories: biology, chemistry and physics.

Anthony Hardwicke



The Hubble Space Telescope: Our Eye on the Universe

Terence Dickinson and Tracy C. Read
New York: Firefly Books, 2019
80 pp. £9.95
ISBN 978 0 2281 0233 5

Nobody can doubt the importance of the Hubble Space Telescope: its images are nothing short of awesome in both visual appeal and scientific significance. But with these images so readily available online at no cost, why would anybody want to spend money on a book-bound collection?

The first reason is the most obvious: no computer is required

to view these images, which can be perused without the weight of a laptop on your knee. The second reason is even more important: a book provides an orderly presentation of information and better opportunities for visual pacing.

Author Terence Dickinson and his publisher, Firefly, have been working together to create beautiful and informative astronomy books for the best part of 20 years, and proof of their success can be measured by scanning Amazon's reviews, where Dickinson's books typically achieve 4.7 stars (appropriately) expressed across more than 1500 reviews.

The latest volume does not disappoint but neither is it perfect. The text has been written for a younger reader and is accessible for its target audience (KS2–KS3) but will probably leave older readers wanting more. The images are all impressive, of course, but the book is compact rather than coffee-table format so even full-page pictures are no more than nine inches square. Resourceful though it is, the attempt to split one image vertically over two consecutive spreads at the end of the book doesn't really work.

Starting with a brief anatomy of the space telescope and a pen portrait of Edwin Hubble himself, the book quickly moves on to the infamous dark-field images that the Hubble Space Telescope first captured alone and later with the Spitzer (IR) Space Telescope. This spread includes a time map that conveys the extent to which these images glimpse back to less than half a billion years after the beginning of the universe. It is followed by a spread that explains how UV, visible light and IR images are combined to make the sorts of images that many viewers imagine can be seen simply by looking through an optical eyepiece. Sadly, things are not so simple!

Having set the scene, *Our Eye on the Universe* then steps upwards in scale from the solar system to our galaxy and beyond, '*peering into darkness and the past*' – as the book eloquently titles the final chapter. There are occasional instances of repetitiveness in the captions but this is an observation rather than a criticism.

Dickinson's latest book would be a visually inspiring addition to KS2 and KS3 bookshelves, feeling durable enough to withstand multiple readers, while also managing to come in under the £10 price point. For those who want something a bit more special, perhaps as a birthday present for a youngster, there is also a hardback edition priced at £19.99 (or less on Amazon).

Jon Tarrant

Reviewers

Alex Chaplin is a former Head of Science and taught science in London schools for over 20 years. He currently works in an FE college.

Anthony Hardwicke teaches GCSE and A-level chemistry at Bradfield College.

Colin Johnson is a senior visiting research fellow in the School of Education, Bristol University. He taught for 24 years in schools and universities, and has since worked extensively in science centres and museums.

Jon Tarrant is Head of Sciences at Grainville School, Jersey.