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BOOK REVIEW

Learning mathematics: What the experts say, edited by John Berry and Chris Pritchard, The Mathematical Association, Leicester, UK, 2024, pp. 272, £9.00 (paperback), ISBN 978-1-911616-36-8

The subtitle of this book is 'Ideas from Fifty Years of *Mathematics in School*', an accurate description of what to expect when you open it. It is divided into seven chapters, each consisting of a selection of articles from the journal, introduced by an Editorial summary.

The first three chapters concern the pedagogy of learning mathematics, which includes the psychology of learning as well as specific skills and levels of understanding related to the teaching of the subject. The last four chapters focus on particular areas of the subject, namely numeracy, algebra, geometry/mechanics, and conjecture/proof. I have to admit, as someone who spent an entire working life in the classroom, that I am much more interested in concrete examples of teaching and learning than in abstract theories. I confess to an innate distrust of any list of references that runs to two pages. Has the author really read all of these, or are they just there for effect, rather like references to Andrew Wiles' paper in claims to have re-discovered Fermat's original argument?

Inevitably, this review is akin to cherry-picking, and, in the process, certain authors stand out as likely to provide stimulating and exciting ideas. They cross boundaries between the two halves of the book. Christopher Zeeman discusses mathematics and creative thinking, asks (without providing an answer) whether it is a science or an art, celebrates creativity and elegance, and suggests a link between algebraic topology and theories of thinking and memory. Tony Gardiner discusses a particular problem: in 14!, what is the units digit? He goes on to analyse the mathematics involved in terms of structure and analysis and provides some salutary principles, in particular making children aware of what is required to solve problems. The only way to learn—he claims—is to think,

make mistakes, reflect on these, and put them right. Jeremy Hodgen and Colin Foster ask, 'what is so hard about algebra?', dismiss a number of pat answers as unhelpful, and conclude that what is important is making the step from the particular to the general. Doug French has some interesting takes on factors and factorials, looking for patterns and developing general truths. In particular, he discusses what can be said about the number of factors in a product of powers and what this depends on. Tom Roper focuses on the assumptions and misconceptions involved in teaching Newtonian mechanics. Marcus de Sautoy uses vampires and viruses to aid an understanding of exponential growth. Paul Andrews uses some concrete activities with frames of cubes to illustrate abstract algebraic principles. Alert readers might notice something all these authors have in common.

I have scarcely touched the wealth of material in the book. There are stimulating chapters on problem-solving by Rob Eastaway, Joe Watson, and Derek Holton, on geometry by Bob Burn and Douglas Hofstadter, and on algebra by Nick Lord, Tony Barnard, and Warwick Sawyer.

I would have appreciated a little more about dealing with fundamental questions such as 'why do two minuses make a plus', not only in establishing what this means and what it doesn't mean, but also what sort of physical representation might be useful in showing why it is patently true. Another area that is a very fertile ground for deepening understanding about number and place value is the analysis of 'times tables' at the primary level. However, all that this is saying is that perhaps there is room for a follow-up book by the same Editors to tackle these and other issues. In the meantime, there is plenty of stimulating material which will, with luck, be of great value to school teachers at all levels.

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https://doi.org/10.1080/00255572.2025.2586905