
Book Reviews

Title: Effective Learning and Teaching in Mathematics & its Applications
Editors: P. Kahn and J. Kyle, Kogan Page 2002, ISBN 0-7494-3569-0

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This book is aimed at teachers in higher education; there are 15 chapters written by different authors. A full review of each chapter would be unreasonably long, so here are brief and uneven notes on the chapters.

- 1 An outline of the problems students face in the transition from secondary to higher education. Includes discussion of diagnostic testing and curriculum support to help students at the start of a course in higher education
- 2 A short and interesting discussion of the difference between textbook expositions of mathematics and the living practice of mathematicians. Many mathematical ideas arose in the first place from specific examples, out of which general theorems and concepts were developed. This article suggests that while conventional textbooks start from general theory, it might be better to develop general ideas out of concrete examples. Some interesting examples at first year undergraduate level.
- 3 An account of the idea of “active learning” and how to help students to develop habits which help them to learn. Some practical advice as well as theoretical discussion including the idea of a “procept”, a combination of a process and a concept. For example, a function is both a mathematical *concept* (a rule, or a subset of a Cartesian product, according to taste), and a *process* by which the argument of a function is transformed into its value. Understanding this dual nature of functions can (arguably) be helpful to students.
- 4 A review of some basic ideas and terminology in mathematics assessment. Lists different types of assessment, and various purposes that assessment can serve. Some discussion of matching assessment to learning outcomes.
- 5 Computer algebra systems: how they can be used to develop students’ understanding of theoretical ideas. Includes an example of an examination paper to be sat in a computer lab using a computer algebra system.
- 6 Embedding transferable skills in the mathematics curriculum, with information on how this is being done at Sheffield Hallam and Ulster. Some useful ideas and references.
- 7 How to design a module starting from a set of aims or “intended learning outcomes”. Particular attention is paid to the question of how *general* aims (for example, the ability to pick out the important ideas from a mass of mathematical details) can be fostered by the design of a module.
- 8 The notion of a “Total Learning Environment” based on interactions between students, tutors, and lecturers.
- 9 A subtle discussion of how teachers can reflect on their teaching and how students respond to it. Includes strategies for developing awareness of how a session (tutorial, lecture etc.) is going, and for overcoming the difficulties which arise in explaining mathematical ideas to students.
- 10 The teaching of numeracy as a general skill for students on non-numerate programmes.
- 11 A broad discussion of the teaching of mathematics to scientists and engineers. Reports and discusses the result of recent surveys and QAA subject overview reports in mathematics, science and engineering. The authors conclude that this whole field has serious structural problems which urgently need action at national level as well as within individual institutions.
- 12 Mathematical modelling in undergraduate education as a way of developing transferable skills. Outlines ways in which modelling can be taught and assessed; includes sample assessment criteria, and a detailed discussion of assessment of group modelling projects.
- 13 Teaching statistics to non-specialists. Stresses the importance of using carefully chosen realistic data. Describes work towards a web resource to provide real data and related worksheets for the teaching of statistics. Also outlines a programme for the statistical education of engineers developed by the Ford Motor Company in collaboration with the Royal Statistical Society’s Quality Improvement Committee.
- 14 The role of proof and logical reasoning in pure mathematics education. Discusses some of the problems presented by first-year students, such as widespread sloppy use of the “implies” symbol (and the “sad demise of ‘therefore’ and ‘because’”). Suggests that students are best introduced to strict logical reasoning in the context of well-understood mathematics rather than through a course of mathematical analysis. There is also a discussion of the relation of educational research to the practice of teaching. Dubinsky’s APOS theory of mathematical education is introduced in the context of teaching the group-theoretical idea of cosets.
- 15 The final chapter, by the editors, summarises some of the above ideas; it draws attention to the need to focus on how students learn and how they can be helped to learn, and it encourages the mathematical community in general, and individual lecturers, to

take a professional approach to the development of better education for our students.

This is a very useful book. The chapters, being written by different authors, are naturally uneven in style and depth. But because they are independent, the book does not have to be read in sequence but can easily be dipped

into for specific topics. It includes basic information for beginners (for example, chapter 4) as well as chapters which should be of interest to experienced teachers (for example, chapter 9). There are references at the ends of chapters and general references at the end of the book. It can be recommended to all mathematics lecturers interested in the quality of their teaching and their students' learning.