

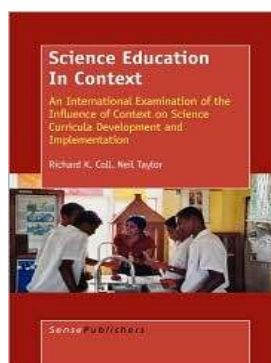
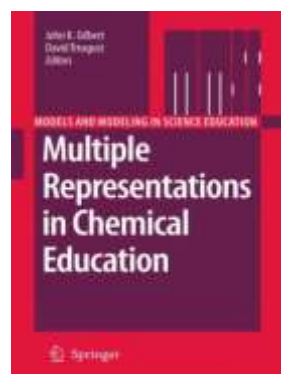
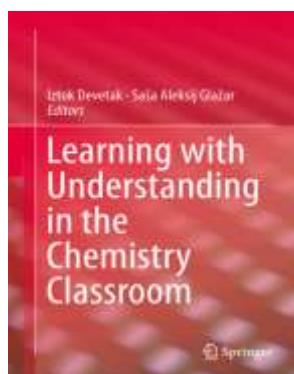
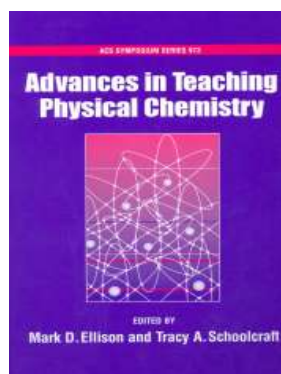
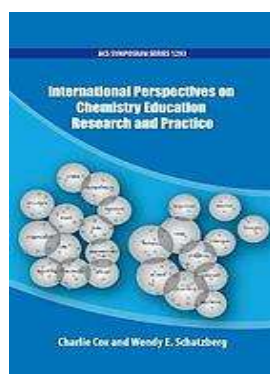
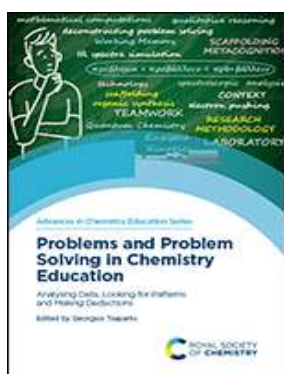
# GEORGIOS TSAPARLIS

Professor Emeritus of Science Education

Department of Chemistry, University of Ioannina, Greece

## A2. SCIENTIFIC WORKS

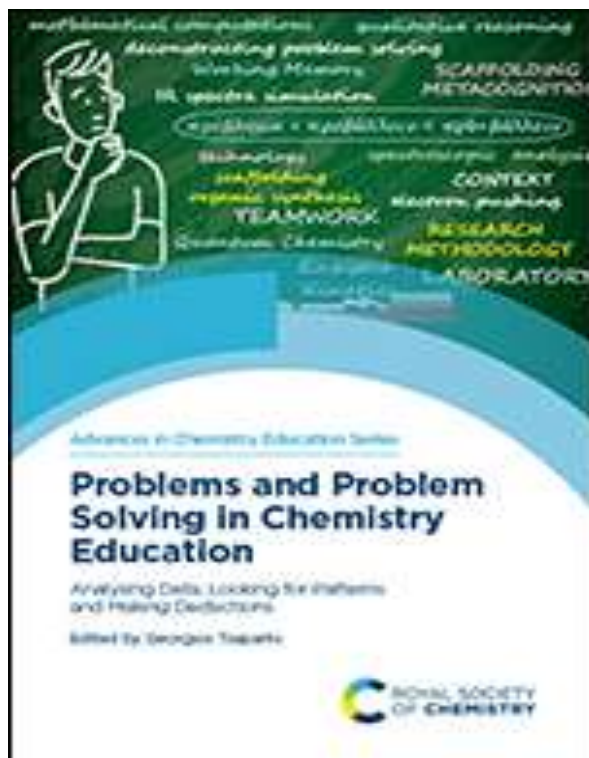
### PART 2: PUBLICATIONS IN INTERNATIONAL BOOKS



MAY 2021

# NEW BOOK: Problems and Problem Solving in Chemistry Education

Editor: Georgios Tsaparis



Royal Society of Chemistry: Advances in Chemistry Education Series

*Published: 19 May 2021*

<https://pubs.rsc.org/en/content/ebook/978-1-83916-218-3>

<http://pubs.rsc.org/bookshop/collections/series?issn=2056-9335>

## About this book

Problem solving is central to the teaching and learning of chemistry at secondary, tertiary and post-tertiary levels of education, opening to students and professional chemists alike a whole new world for analysing data, looking for patterns and making deductions. As an important higher-order thinking skill, problem solving also constitutes a major research field in science education. Relevant education research is an ongoing process, with recent developments occurring not only in the area of quantitative/computational problems, but also in qualitative problem solving.

The following situations are considered, some general, others with a focus on specific areas of chemistry: quantitative problems, qualitative reasoning, metacognition and resource activation, deconstructing the problem-solving process, an overview of the working memory hypothesis, reasoning with the electron-pushing formalism, scaffolding organic synthesis skills, spectroscopy for structural characterization in organic chemistry, enzyme kinetics, problem solving in the academic chemistry laboratory, chemistry problem-solving in context, team-based/active learning, technology for molecular representations, IR spectra simulation, and computational quantum chemistry tools. The book concludes with methodological and epistemological issues in problem solving research and other perspectives in problem solving in chemistry.

# Contents

## Foreword

George M. Bodner

## Preface

Georgios Tsaparlis

## Acknowledgements

## Dedication

## Authors' Biographies

## Contents

### CHAPTER 1 Introduction –The Many Types and Kinds of Chemistry Problems

Georgios Tsaparlis

### PART I: GENERAL ISSUES IN PROBLEM SOLVING IN CHEMISTRY EDUCATION

### CHAPTER 2 Qualitative Reasoning in Problem-solving in Chemistry

Vicente Talanquer

### CHAPTER 3 Scaffolding Metacognition and Resource Activation During Problem Solving: A Continuum Perspective

Nicole Graulich, Axel Langner, Vo Kimberly and Elizabeth Yuriev

### CHAPTER 4 Deconstructing the Problem-solving Process: Beneath Assigned Points and Beyond Traditional Assessment

Ozcan Gulacar, Charlie Cox and Herb Fynewever

### CHAPTER 5 It Depends on the Problem and on the Solver: An Overview of the Working Memory Overload Hypothesis, Its Applicability and Its Limitations

Georgios Tsaparlis

### PART II: PROBLEM SOLVING IN ORGANIC CHEMISTRY AND BIOCHEMISTRY

### CHAPTER 6 Mechanistic Reasoning Using the Electron-pushing Formalism

Gautam Bhattacharyya

### CHAPTER 7 Scaffolding Synthesis Skills in Organic Chemistry

Alison B. Flynn

### CHAPTER 8 Problem Solving Using NMR and IR Spectroscopy for Structural Characterization in Organic Chemistry

Megan C. Connor and Ginger V. Shultz

### CHAPTER 9 Assessing System Ontology in Biochemistry: Analysis of Students' Problem Solving in Enzyme Kinetics

Jon-Marc G. Rodriguez, Sven J. Philips, Nicholas P. Hux and Marcy H. Towns

### **PART III: CHEMISTRY PROBLEM SOLVING IN SPECIFIC CONTEXTS**

#### **CHAPTER 10 Problem Solving in the Chemistry Teaching Laboratory: Is This Something That Happens?**

Ian Hawkins, Vichuda K. Hunter, Michael J. Sanger and Amy J. Phelps

#### **CHAPTER 11 Problems and Problem Solving in the Light of Context-based Chemistry**

Karolina Broman

#### **CHAPTER 12 Using Team Based Learning to Promote Problem Solving Through Active Learning**

Natalie J. Capel, Laura M. Hancock, Chloe Howe, Graeme R. Jones, Tess R. Phillips and Daniela Plana

### **PART IV: NEW TECHNOLOGIES IN PROBLEM SOLVING IN CHEMISTRY**

#### **CHAPTER 13 Technology, Molecular Representations, and Student Understanding in Chemistry**

Jack D. Polifka, John Y. Baluyut and Thomas A. Holme

#### **CHAPTER 14 An Educational Software for Supporting Students' Learning of IR Spectral Interpretation**

Maria Limniou, Nikos Papadopoulos, Dimitris Gavril, Aikaterini Touni and Markella Chatziapostolidou

#### **CHAPTER 15 Exploring Chemistry Problems with Computational Quantum Chemistry Tools in the Undergraduate Chemistry Curriculum**

Michael P. Sigalas

### **PART V: NEW PERSPECTIVES FOR PROBLEM SOLVING IN CHEMISTRY EDUCATION**

#### **CHAPTER 16 Methodological and Epistemological Issues in Science Education Problem-solving Research: Linear and Nonlinear Paradigms**

Dimitrios Stamovlasis and Julie Vaiopoulou

#### **CHAPTER 17 Issues, Problems and Solutions: Summing It All Up**

Georgios Tsaparlis

#### **CHAPTER 18 Postscript – Two Issues for Provocative Thought: (a) The Potential Synergy Between HOTS and LOTS (b) When Problem Solving Might Descend to Chaos Dynamics**

Georgios Tsaparlis

#### **Subject Index**

## **ARTICLE IN INTERNATIONAL ENCYCLOPEDIA OF SCIENCE EDUCATION**

Ba.1. Tsaparlis G. (2015). Cognitive demand. In Gunstone R (Ed.) Encyclopedia of Science Education, pp 164-167. Springer Dordrecht, Heidelberg, New York, London  
ISBN: 978-94-007-2149-4 (Print) 978-94-007-2150-0 (Online)  
<http://link.springer.com/referencework/10.1007/978-94-007-2150-0>

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Ba.2. Tsaparlis, G. (2004). Atomic structure. In L.J. Lagoswski (Ed.), Chemistry: Foundations and Applications (four-volume illustrated encyclopedia, Vol. 1, pp. 78-87. MacMillan.

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Bb.2. Tsaparlis. G. (2000). Problem solving in chemistry in science education. In M. Ahtee et al. (eds.), *Research on mathematics and science education*, pp. 67-87. University of Jyvaskyla, Finland: Institute for Educational Research.

Bb.3. Stamovlasis, D. & Tsaparlis, G. (2003). Nonlinear analysis of the effect of working memory capacity on student performance in problem solving. In D. Psillos et al. (Eds.), *Science education in the knowledge-based society*, pp. 183-190. Kluwer Academic Publishers.

- Bb.4. G. Tsaparlis (2007). **Teaching and learning physical chemistry – Review of educational research**. In M.D. Ellison & T.A. Schoolcraft (Eds.), **Advances in Teaching Physical Chemistry**, Ch. 7. Washington DC: American Chemical Society (Distributed by Oxford University Press). ISBN: 978-0-8412-3998-2 (paperback) / 0841239983 hardback
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- Tsaparlis G. & Sevian H. (eds.) (2013). **Concepts of Matter in Science Education**. Vol. 19 in Series: Innovations in Science Education and Technology. ISBN 978-94-007-5913-8 Hardcover, ISBN 978-94-007-5914-5 (eBook) (Springer)
- Bb9. G. Tsaparlis & H. Sevian (2013). H. **Concepts of matter – complex to teach and difficult to learn** (Introductory chapter in Bb9). (pp. 1-8)
- Bb.10. G. Tsaparlis (2013). **Learning and teaching the basic quantum chemical concepts** (in **Concepts of Matter in Science Education**) (pp. 437-460).
- Bb.11. G. Tsaparlis & H. Sevian (2013). **Toward a scientifically sound understanding of concepts of matter** (Concluding chapter in **Concepts of Matter in Science Education**) (pp. 485-520)
- Bb.12. Tsaparlis G. (2018). **Challenges, Barriers, and Achievements in Chemistry Education: The Case of Greece**. In C. Cox and W. E. Schatzberg (eds.), **International Perspectives on Chemistry Education Research and Practice**, Ch. 7, pp. 93-110. Washington, DC, American Chemical Society. ISBN13: 9780841233461 (print); eISBN: 9780841233430 (electronic).

- Tsaparlis, G. (ed.) (2021). **Problems and Problem Solving in Chemistry Education**, Royal Society of Chemistry (book 7 in series: Advances in Chemistry Education Series. *Published: 19 May 2021*)
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- Bb.14. Tsaparlis, G. (2021). **It Depends on the Problem and on the Solver: An Overview of the Working Memory Overload Hypothesis, Its Applicability and Its Limitations**, Ch. 5, in **Problems and problem solving in chemistry education** (pp. 93-126).
- BB.15. Tsaparlis, G. (2021). **Issues, Problems and Solutions: Summing It All Up** in G. Tsaparlis (ed.), Ch. 17, in **Problems and problem solving in chemistry education** (pp. 414-444).
- BB.16. Tsaparlis, G. (2021). **Postscript – Two Issues for Provocative Thought: (a) The Potential Synergy Between HOTS and LOTS (b) When Problem Solving Might Descend to Chaos Dynamics**. Ch. 18, **Problems and problem solving in chemistry education** (pp. 445-456).

# International Perspectives on Chemistry Education Research and Practice

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## **CHAPTER 7, pp. 93-110**

Challenges, Barriers, and Achievements in Chemistry Education: The Case of Greece

Georgios Tsaparlis



# Encyclopedia of Science Education\*

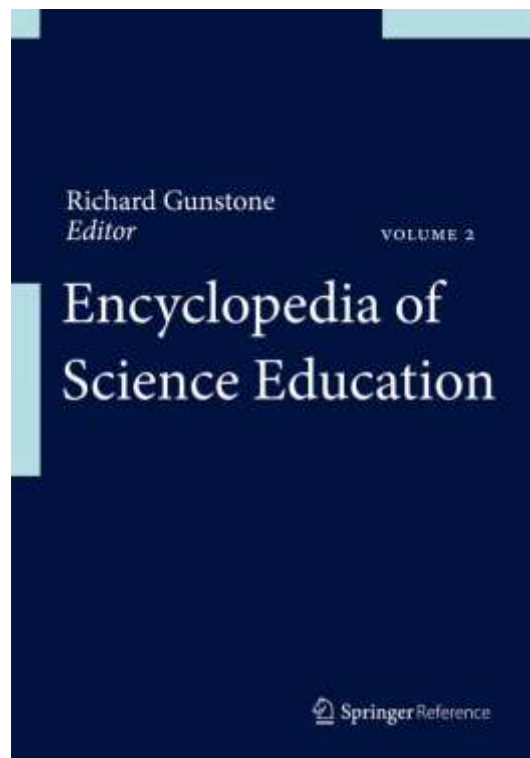
R. Gunstone (Editor)

Springer Dordrecht, Heidelberg, New York, London

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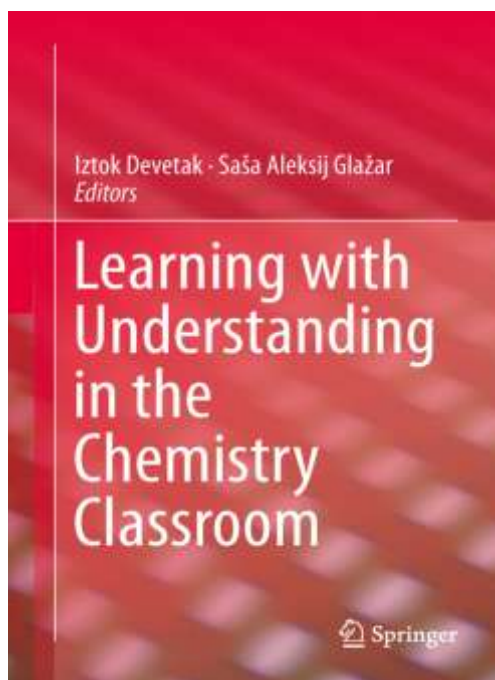
<http://link.springer.com/referencework/10.1007/978-94-007-2150-0>



Georgios Tsaparis (2015). Cognitive demand, pp 164-167.

***Learning with understanding in the chemistry classroom***

**I. Devetak & S. A. Glažar (editors.)**



ISBN 978-94-007-4365-6 (Springer)

**Georgios Tsaparis, Linking the macro with the submicro levels of chemistry:  
demonstrations and experiments that can contribute to  
active/meaningful/conceptual learning.**

**pp. 41-61.**

**EDITED VOLUME<sup>&</sup> (PUBLISHED JULY 2013 BY SPRINGER)**

Tsaparlis G. & Sevian H. (eds.) *Concepts of Matter in Science Education*. Vol. 19 in Series: Innovations in Science Education and Technology. ISBN 978-94-007-5913-8 Hardcover, ISBN 978-94-007-5914-5 (eBook) (Springer) For more information about the book, including the contents, see below or <http://www.springer.com/education+%26+language/science+education/book/978-94-007-5913-8>

<sup>&</sup> *This volume resulted from the International Symposium which Georgios Tsaparlis organized in Athens, Greece, in 2010 (with George Kalkanis). Authors include: George Bodner, Avi Hofstein, Philip Johnson, Loretta Jones, Joseph Krajcik, Keith Taber, Vicente Talanquer, David Treagust, Marianne Wiser.]*

In this book, G. Tsaparlis is author or co-author of the following three chapters:

- G. Tsaparlis & H. Sevian. *H. Concepts of matter – complex to teach and difficult to learn* (Introductory chapter) . (pp. 1-8)
- G. Tsaparlis, *Learning and teaching the basic quantum chemical concepts*. (pp. 437-460)
- G. Tsaparlis & H. Sevian, *Toward a scientifically sound understanding of concepts of matter* (Concluding chapter) (pp. 485-520)



## ABOUT THIS BOOK:

- Covers a central topic in science and chemistry education
- Examines teaching and learning concepts at every level from pre-school through post-graduate studies
- Coverage includes students' and teachers' mental models regarding the particulate nature of matter

Bringing together a wide collection of ideas, reviews, analyses and new research on particulate and structural concepts of matter, *Concepts of Matter in Science Education* informs practice from pre-school through graduate school learning and teaching and aims to inspire progress in science

education. The expert contributors offer a range of reviews and critical analyses of related literature and in-depth analysis of specific issues, as well as new research. Among the themes covered are learning progressions for teaching a particle model of matter, the mental models of both students and teachers of the particulate nature of matter, educational technology, chemical reactions and chemical phenomena, chemical structure and bonding, quantum chemistry and the history and philosophy of science relating to the particulate nature of matter. The book will benefit a wide audience including classroom practitioners and student teachers at every educational level, teacher educators and researchers in science education.

"If gaining the precise meaning in particulate terms of what is solid, what is liquid, and that air is a gas, were that simple, we would not be confronted with another book which, while suggesting new approaches to teaching these topics, confirms they are still very difficult for students to learn".

Peter Fensham,  
*Emeritus Professor Monash University, Adjunct Professor QUT*  
(from the foreword to this book)

**Content Level » Research**

## Table of contents

PETER FENSHAM Foreword.- GEORGIOS TSAPARLIS AND HANNAH SEVIAN Introduction: Concepts of matter – Complex to teach and difficult to learn - PART I: LEARNING PROGRESSIONS FOR TEACHING A PARTICLE MODEL OF MATTER.- JOI MERRITT AND JOSEPH KRAJCIK Learning progression developed to support students in building a particle model of matter.- PHILIP JOHNSON How students' understanding of particle theory develops: A learning progression.- HANNAH SEVIAN AND MARILYNE STAINS Implicit assumptions and progress variables in a learning progression about structure and motion of matter.- MARIANNE WISER, KATHRYN E. FRAZIER AND VICTORIA FOX At the beginning was amount of material: A learning progression for matter for early elementary grades.- PART II: STUDENTS' AND TEACHERS' MENTAL MODELS OF THE PARTICULATE NATURE OF MATTER.- DAVID F. TREAGUST, A. L. CHANDRASEGARAN, LILIA HALIM, ENG TEK ONG, AHMAD NURULAZAM MD ZAIN AND MAGESWARY KARPUDEWAN Understanding of basic particle nature of matter concepts by secondary school students following an intervention program.- MEI-HUNG CHIU AND SHIAO-LAN CHUNG The use of multiple perspectives of conceptual change to investigate students' mental models of gas particles.- CANAN NAKIBOĞLU AND KEITH S. TABER The atom as a tiny solar system: Turkish high school students' understanding of the atom in relation to a common teaching analogy.- ELENI PETRIDOU, DIMITRIS PSILLOS, EURIPIDES HATZIKRANIOTIS AND MARIA KALLERY A study on the exploratory use of microscopic models as investigative tools: The case of electrostatic polarization.- INGO EILKS Teacher pathways through the particulate nature of matter in lower secondary school chemistry: Continuous switching between different models or a coherent conceptual structure?.- FAIK Ö. KARATAŞ, SUAT ÜNAL, GREGORY DURLAND AND GEORGE BODNER What do we know about students' beliefs? Changes in students' conceptions of the particulate nature of matter from pre-instruction to college.- AJDA KAHVECI Diagnostic assessment of student understanding of the particular nature of matter: Decades of research.- PART III: EDUCATIONAL TECHNOLOGY.- SEVIL AKAYGUN AND LORETTA L. JONES Dynamic visualizations: Tools for understanding the particulate nature of matter.- GEORGE KALKANIS From the scientific to the educational: Using Monte Carlo simulations of the microKosmos for science education by inquiry.-PART IV: CHEMICAL REACTIONS, CHEMICAL PHENOMENA.- GEORGE PAPAGEORGIOU Can simple particle models support satisfying explanations of chemical changes for young students?.- VICENTE TALANQUER How do students reason about chemical substances and reactions?.- KEITH S. TABER AND KARINA ADBO Developing chemical understanding in the explanatory vacuum: Swedish high school students' use of an anthropomorphic conceptual framework to make sense of chemical phenomena.- PART V: CHEMICAL STRUCTURE AND BONDING.- TAMI LEVY NAHUM, RACHEL MAMLOK-NAAMAN AND AVI HOFSTEIN Teaching and learning of the chemical bonding concept: Problems and some pedagogical issues and recommendations.- KEITH S. TABER A common core to chemical conceptions: Learners' conceptions of chemical stability, change and bonding.- MARIJN R. MEIJER, ASTRID M. W. BULTE AND ALBERT PILOT Macro-Micro thinking with structure-property relations: Integrating 'meso levels' in secondary education.- GEORGIOS TSAPARLIS Learning and teaching the basic quantum chemical concepts.- PART VI: HISTORY AND PHILOSOPHY OF SCIENCE.- CONSTANTINE D. SKORDOULIS AND VANGELIS KOUTALIS Investigating the historical development of the concept of matter: Controversies about/in ancient atomism.- GEORGIOS TSAPARLIS AND HANNAH SEVIAN Toward a scientifically sound understanding of concepts of matter.



**Teaching Secondary  
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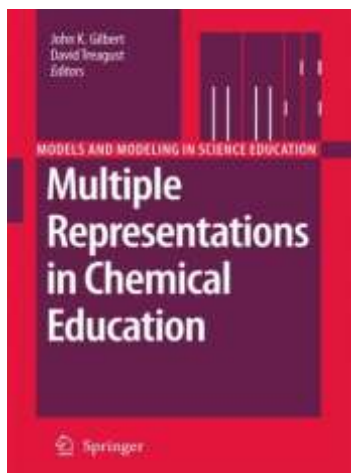
**ISBN:** 9781444124323  
**Published:** 29/06/2012  
**Extent:** 400 pages

**Keith Taber (editor)**

**Contents:**

- 1 Key concepts in chemistry
- 2 Introducing particle theory
- 3 Introducing chemical change
- 4 Developing models of chemical bonding
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## **Multiple Representations in Chemical Education**

Series: Models and Modeling in Science education, Vol. 4

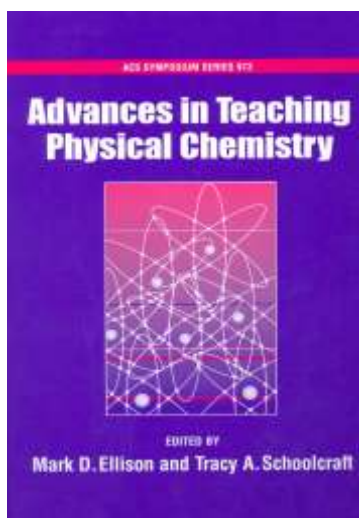
SPRINGER 2009, X, 370 p., Hardcover  
ISBN: 978-1-4020-8871-1

**John K. Gilbert & David Treagust (Eds.)**

### **ABOUT THIS BOOK**

Understanding the triplet (macro, sub-micro, and symbolic) relationship is a key aspect of chemical education, but there is considerable evidence that students find great difficulty in achieving mastery of the ideas involved. In bringing together the work of leading chemistry educators who are researching the triplet relationship at the secondary and university levels, the book discusses the learning involved, the problems that students encounter, and successful approaches to teaching.

**Written for:** Chemistry teacher educators, chemistry curriculum designers, chemical education researchers



**Advances in Teaching  
Physical Chemistry**

**Mark D Ellison and  
Tracy A Schoolcraft (Editors)**

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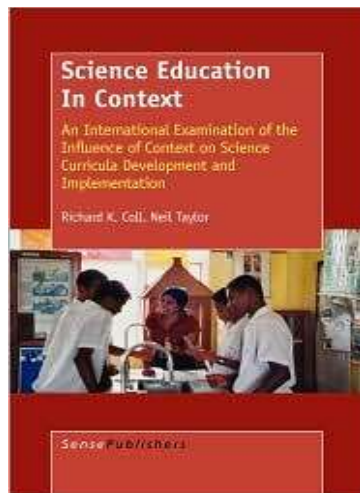
Distributed by  
Oxford University Press

ISBN: 9780841239982 (paperback)  
ISBN: 0841239983 hardback,  
342 pages

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This book brings together the latest perspectives and ideas on teaching modern physical chemistry. It includes perspectives from experienced and well-known physical chemists, [a thorough review of the education literature pertaining to physical chemistry](#), a thorough review of advances in undergraduate laboratory experiments from the past decade, in-depth descriptions of using computers to aid student learning, and innovative ideas for teaching the fundamentals of physical chemistry. This book will provide valuable insight and information to all teachers of physical chemistry.





## Science Education in Context

*An international perspective of the influence of context on science curricula development, and implementation*

**R.K. Coll and N. Taylor (Eds.)**

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## RESEARCH ON MATHEMATICS AND SCIENCE EDUCATION

From Beliefs to Cognition from Problem Solving to  
Understanding

*Maija Ahtee, Ole Björkvist, Erkki Pehkonen and Virpi  
Vatanen (Eds.)*

2001. 134 p. EUR 14 inc VAT . Ordernumber D052.

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THIS BOOK contains a selection of the papers presented at the seminars of the Finnish Association for Research in Mathematics and Science Education and the Finnish Graduate School of Mathematics, Physics and Chemistry Education. It thus gives a brief insight into some recent research interests in mathematics, physics and chemistry education in Finland. The volume also contains papers by professor Laurence Viennot, Universite Paris VII, France, and professor Georgios Tsaparlis, Univeristy of Ioannina, Greece, who gave lectures and workshops at the spring seminar of the Graduate School in Joensuu, and by professor Erkki Pehkonen, who gave a lecture at the summer seminar in Vaasa. The book is meant especially to stimulate international feedback on Finnish research in mathematics and science education. (Institute for Educational Research, University of Jyväskylä, Finland)

*Problem solving in chemistry and science education*, G. Tsaparlis, pp. 67-87.