

University Science and Mathematics
Education in Transition

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Editors

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 Springer

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Preface

Improving the quality of science and mathematics education at universities has been a task to which governments and tertiary education institutions have committed. This was the case in Denmark at the end of the 1990s when the Danish Government, its Ministry of Research, and a network of Universities gathered efforts around the construction and functioning of the Centre for Educational Development in University Science. The centre established collaboration between seven Danish universities around the teaching and learning of science: Aalborg University, Copenhagen University, the Danish University of Education, the Pharmaceutical University, Roskilde University Centre, the Royal Veterinarian and Agricultural University, and the University of Southern Denmark. The centre operated during the period 1998-2001, thanks to the generous funding of 35 millions of Danish Kroner in total.

The Centre for Educational Development in University Science embraced a wide range of educational research and development activities through which the practice of university science education was addressed and improved. Areas such as mathematics, physics and chemistry education were central. The centre ran a Ph.D. programme, which enrolled 12 students who addressed a variety of educational issues in the subject areas of relevance for the centre. The centre also organised a series of conferences and seminars aiming at the professional development of teaching staff in the institutions associated. The centre financed a number of teaching development projects run by university staff in their own institutions and classrooms. Many leading scholars from around the world made important contributions to the work of the centre.

The present book emerged from the wide-ranging network of research and researchers, established through the Centre for Educational Development in University Science. The intention of the book, however, is not to provide any report of the research or developmental activities of the centre, but rather to contribute to the worldwide concern for analysing both challenges and possibilities for university science and mathematics education. Even if the book collects a majority of papers by Danish authors working in Danish contexts, the issues addressed by the different sections and chapters are of a general relevance for tertiary educational environments around the world. Furthermore, the dialogue between the Danish authors and leading international researchers in the field contributes reinforcing the broadness

of the book for an international audience, in a changing world where transitions in what is considered to be the core of science and mathematics education in universities are taking place.

We want to thank all the people who have contributed to the completion of this volume. Thanks to the Danish Ministry of Research and to Aalborg University for providing the necessary funding for editing the book. Thanks to Patricia Perry for a careful typographical editing of the manuscript, to Anette Larsen for editorial support, and to Anne Kepple for a language revision of several of the chapters. And thanks to Marie Sheldon and Kristina Wiggings and other members of the staff at Springer for their support and guidance during the edition process.

Finally, we would like to dedicate this collection to the memory of Leone Burton, a remarkable colleague and friend who during very many years supported our work participating in some of the activities of the Centre for Educational Development in University Science, conducting sessions with research students and staff in Denmark, and being a critical partner in our previous work and in an early stage of production of this collection. We are honoured to publish her paper, probably the last printed record of her prolific and pathbreaking academic career.

Aalborg, May 2008

Ole Skovsmose
Paola Valero
Ole Ravn Christensen

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Leone Burton[‡] was Professor of Education (Mathematics and Science) at the University of Birmingham, England. She was a strong advocate for girls/women in mathematics, who wrote widely on gender-based aspects of mathematics education. Burton contributed significantly to developing teaching approaches that promote mathematical thinking. Her book *Mathematicians as Enquirers: Learning about Learning Mathematics* provides a deep insight in to inquiry processes in mathematical research, on the basis of which it is possible to investigate learning processes in a variety of school contexts in great detail. Burton studied the ways in which society and culture have shaped mathematics, examining similarities and differences in mathematical concepts and topics. Leone Burton passed away in 2007.

John A. Bowden is Professor Emeritus at RMIT University and Adjunct Professor at Swinburne University of Technology, in Melbourne, Australia. He has a research and teaching background in chemistry at the University of Melbourne and in educational development at both the University of Melbourne and RMIT University. In 2004 he retired as Professor of Educational Development at RMIT where he had been Director of the Educational Program Improvement Group, Dean of the Faculty of Education and Senior Policy Advisor to the Deputy Vice-Chancellor. The University of Gothenberg awarded him an honorary doctorate in 1998 for his contribution to Swedish university education and Chalmers University, Gothenburg, appointed him William Chalmers Guest Professor, 2001-2003. He has over 150 publications to his name, including *The University of Learning: Beyond Quality and Competence* and *Doing Developmental Phenomenography*. His most recent contributions to research have been to integrate knowledge content, generic attributes and workplace competence into a capabilities-driven curriculum design theory and to establish developmental phenomenography, a modified qualitative research approach.

Ole Ravn Christensen is Associate Professor at the Department of Education, Learning and Philosophy, Aalborg University, Denmark. He obtained a M.Sc. degree in mathematics from Aalborg University (1999), and in 2004 he received a Ph.D. degree from the same institution. Ole Ravn Christensen is Leader of the Board of Studies for Education, Learning and Philosophy. His doctoral dissertation explored the ethical demands faced by university studies in sciences and technology. Through his research he has addressed science and mathematic education, acknowledging the

post-modern condition. In particular he has combined these studies with a specific interpretation of Wittgenstein's conception of language and knowledge.

Kathrine Krageskov Eriksen obtained a M.Sc. degree in biochemistry from the University of Copenhagen (1998), and in 2004 received a Ph.D. degree also from the University of Copenhagen. Her doctoral dissertation focused on the reflective dimension university chemistry education. Eriksen has published within the field of molecular biology and on the issues of chemistry, ethics and science education. Her current research interests concern science education, social responsibility, and processes of reflectivity. Eriksen has been involved in the organisation of various groups and conferences promoting the integration of philosophical and ethical considerations in university science curricula. She is leader of the educational programme in medical laboratory technology at University College Sealand, in Denmark.

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teaching and curriculum as non-causal relation focusing on empirical studies of teacher education and curriculum in higher education.

Kjeld Bagger Laursen has been a university teacher and researcher of mathematics since the middle 1960s. He has been Head of the Centre for Science Education at the University of Copenhagen, Denmark. He has been Director of Studies in Mathematics, also at the University of Copenhagen. He became Doctor of Science, University of Copenhagen in 1991 and has been an invited lecturer at several international conferences on Banach Algebras and Operator Theory. He was the President of the Danish Mathematical Society 1990–1994.

John Mason is Professor of Mathematics Education at the Open University, England and Senior Research Fellow at Oxford in the Department of Education. Originally a mathematician (Combinatorial Geometry), he was a Co-Founder of the Centre for Mathematics Education at the Open University. He has written hundreds of research papers and a dozen or more books, all aimed at supporting those who find themselves promoting, sustaining, and supporting mathematical thinking in themselves and in others. For more than 45 years, John Mason has been enquiring into what it means to think mathematically, and supporting others in all phases of education who either want to develop their own mathematical thinking, or to support others in doing this. His interests are currently focused on the design of pedagogically effective tasks, and the ways in which the structure of attention of teachers and learners interact to support the appreciation of mathematical reasoning.

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Ole Skovmose has a special interest in critical mathematics education. He has investigated the notions of mathematics in action, students' foreground, globalisation, ghettoising with particular reference to mathematics education. He is Professor at Department of Education, Learning and Philosophy, Aalborg University, Denmark. He has Authored and co-Authored many books including *Towards a Philosophy of Critical Mathematics Education* (1994); *Educação Matemática Crítica: A Questão da Democracia* (2001); *Dialogue and Learning in Mathematics Education: Intention, Reflection, Critique* (together with Helle Alrø, 2002) and *Travelling Through Education: Uncertainty, Mathematics, Responsibility* (2005). He serves in the Editorial Board of several scientific journals. He has been Co-Director of The Centre for Research of Learning Mathematics, a co-operative project between different universities.

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