

MICHAEL REISS and KENNETH RUTHVEN

ENHANCING THE PARTICIPATION, ENGAGEMENT
AND ACHIEVEMENT OF YOUNG PEOPLE IN SCIENCE
AND MATHEMATICS EDUCATION: INTRODUCTION

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The theme of this special issue—enhancing the participation, engagement and achievement of young people in science and mathematics education—is one currently exercising governments around the world, challenging researchers in science and mathematics education to inform the development of policy and practice. This special issue provides an international forum for a range of contemporary research and scholarship addressing this theme.

The opening three papers focus on the engagement in science and mathematics of students at different stages in the educational system; the research they report is particularly concerned to identify factors that shape students' current engagement and future participation in science and mathematics. Examining the science aspirations of English primary school pupils, Dewitt and colleagues find that, beyond pupils' attitudes towards school science and self-concept in science, such aspirations are strongly associated with pupils' images of scientists, their engagement in science-related activities outside of school and the attitudes to science of their parents. Reiss and colleagues discuss the methodology of their research into how the developing identities of young people in Britain shape their participation in advanced study of mathematics and physics across the transition from secondary school to university; they argue that a more rounded account of such issues can be achieved through triangulating the insights gained from a diverse range of approaches and perspectives. Smith and Cooke report on a comparative study of the university experiences of science and humanities undergraduates in the (relatively specialised) English system; they conclude that students who come to university to study science are relatively strongly committed to remaining in the field upon graduation and to continuing to a long-term career there.

Moving beyond personal and structural factors that influence young people's orientation towards science and mathematics, the next pair of papers address the crucial issue of pedagogies of engagement. Newton

and Newton compare ideas from the research literature with the conceptions that English pre-service primary teachers have about characteristics of engaging science lessons; the paper highlights the rudimentary notions that pre-service teachers bring to their training and identifies potential to refine and develop these within a training programme. Drawing on a range of research undertaken in New Zealand, Cowie and colleagues argue that a sociocultural perspective on identity opens up new ways of thinking about engagement that point to novel strategies: reconceptualising assessment, building on student funds of knowledge and breaching the classroom walls.

The 'contextualisation' of mathematics has been a favoured line of development for securing more productive engagement of young people in studying the subject. Beswick offers a critical synthesis of a range of previous research and scholarship that has examined such approaches, reviewing the varying purposes and rationales advanced and assessing the supporting evidence and argument. Looking more specifically at the potential benefits of a coordinated treatment of mathematics and science, Howe and colleagues compare variants of a teaching programme focused on reasoning with intensive quantities, using different forms of mathematical representation; they find that such coordination is beneficial and that choice of representation is influential on the spectrum of benefits.

Systemic improvement efforts in school science and mathematics can now draw on series of international studies and on various forms of systematic research review. Scoping development of an initiative in lower-secondary mathematics and science teaching, Ruthven offers a critical synopsis of the conceptual frameworks, analytic approaches and substantive findings of recent attempts to synthesise the now extensive body of pedagogical research relating to school science and mathematics.

The final three papers examine the implementation of improvement initiatives aimed at enhancing the participation, engagement and achievement of young people in science and mathematics education. Working with secondary school teachers in the USA, Shirley and colleagues examine how uptake of connected classroom technology is influenced by teachers' perceptions of its practicality: in terms of its congruence with their values and practice, its compatibility with existing school structures and the favourableness of its cost/benefit ratio. In the context of English curriculum development initiatives intended to open up new pathways aimed at increasing and broadening participation in continuing study of mathematics, Noyes and colleagues examine the varying interpretations of an innovative application-, modelling- and technology-oriented course that have arisen in policy debate and school implementation. Drawing on

experience from a sustained New Zealand system-wide research-based initiative for numeracy development at primary school level, Higgins and Parsons discuss the contribution of an iterative annual cycle of policy formulation, implementation and evaluation intended to support the process of taking a programme to scale.

Our motivation to undertake this special issue arose from our participation in an ongoing UK Targeted Initiative on Science and Mathematics Education (<http://tisme-scienceandmaths.org/>) supported by the Economic and Social Research Council and allied organisations. In serving as editors, we have valued learning about research taking place around the world on enhancing the participation, engagement and achievement of young people in science and mathematics education and hope to have further opportunities to do so. From an integrative *IJSME* perspective, we have been encouraged by the number of papers in this special issue that attend both to science and to mathematics education.

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Michael Reiss
Institute of Education
University of London
20 Bedford Way, London, WC1H 0AL, UK
E-mail: M.Reiss@ioe.ac.uk

Kenneth Ruthven
Faculty of Education
University of Cambridge
184 Hills Road, Cambridge, CB2 8PQ, UK
E-mail: kr18@cam.ac.uk