

University Science And Mathematics Education In Transition

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University Science and Mathematics Education in Transition

More than ever, our time is characterised by rapid changes in the organisation and the production of knowledge. This movement is deeply rooted in the evolution of the scientific endeavour, as well as in the transformation of the political, economic and cultural organisation of society. In other words, the production of scientific knowledge is changing both with regard to the internal development of science and technology, and with regard to the function and role science and technology fulfill in society. This general social context in which universities and knowledge production are placed has been given different names: the informational society, the knowledge society, the learning society, the post-industrial society, the risk society, or even the post-modern society. A common feature of different characterisations of this historic time is the fact that it is a period in construction. Parts of the world, not only of the First World but also chunks of the Developing World, are involved in these transformations. There is a movement from former social, political and cultural forms of organisation which impact knowledge production into new forms. These forms drive us into forms of organisation that are unknown and that, for their very same complexity, do not show a clear ending stage. Somehow the utopias that guided the ideas of development and progress in the past are not present anymore, and therefore the transitions in the knowledge society generate a new uncertain world. We find ourselves and our universities to be in a transitional period in time. In this context, it is difficult to avoid considering seriously the challenges that such a complex and uncertain social configuration poses to scientific knowledge, to universities and especially to education in mathematics and science. It is clear that the transformation of knowledge outside universities has implied a change in the routes that research in mathematics, science and technology has taken in the last decades. It is also clear that in different parts of the world these changes have happened at different points in time. While universities in the "New World" (the American Continent, Africa, Asia and Oceania) have accommodated their operation to the challenges

of the construction in the new world, in many European countries universities with a longer existence and tradition have moved more slowly into this time of transformation and have been responding at a less rapid pace to environmental challenges. The process of tuning universities, together with their forms of knowledge production and their provision of education in science and mathematics, with the demands of the informational society has been a complex process, as complex as the general transformation undergoing in society. Therefore an understanding of the current transitions in science and mathematics education has to consider different dimensions involved in such a change. Traditionally, educational studies in mathematics and science education have looked at changes in education from within the scientific disciplines and in the closed context of the classroom. Although educational change in the very end is implemented in everyday teaching and learning situations, other parallel dimensions influencing these situations cannot be forgotten. An understanding of the actual potentialities and limitations of educational transformations are highly dependent on the network of educational, cultural, administrative and ideological views and practices that permeate and constitute science and mathematics education in universities today. This book contributes to understanding some of the multiple aspects and dimensions of the transition of science and mathematics education in the current informational society. Such an understanding is necessary for finding possibilities to improve science and mathematics education in universities all around the world. Such a broad approach to the transitions happening in these fields has not been addressed yet by existing books in the market.

Projects Speak for Themselves 1993/4

This book examines the kinds of transitions that have been studied in mathematics education research. It defines transition as a process of change, and describes learning in an educational context as a transition process. The book focuses on research in the area of mathematics education, and starts out with a literature review, describing the epistemological, cognitive, institutional and sociocultural perspectives on transition. It then looks at the research questions posed in the studies and their link with transition, and examines the theoretical approaches and methods used. It explores whether the research conducted has led to the identification of continuous processes, successive steps, or discontinuities. It answers the question of whether there are difficulties attached to the discontinuities identified, and if so, whether the research proposes means to reduce the gap – to create a transition. The book concludes with directions for future research on transitions in mathematics education.

Transitions in Mathematics Education

This edited book brings together for the first time an international collection of work focused on two important aspects of any young child's life – learning mathematics and starting primary or elementary school. The chapters take a variety of perspectives, and integrate these two components in sometimes explicit and sometimes more subtle ways. The key issues and themes explored in this book are: the mathematical and other strengths that all participants in the transition to school bring to this period of a child's life; the opportunities provided by transition to school for young children's mathematics learning; the importance of partnerships among adults, and among adults and children, for effective school transitions and mathematics learning and teaching; the critical impact of expectations on their mathematics learning as children start school; the importance of providing children with meaningful, challenging and relevant mathematical experiences throughout transition to school; the entitlement of children and educators to experience assessment and instructional pedagogies that match the strengths of the learners and the teachers; the importance for the aspirations of children, families, communities, educators and educational organisations to be recognised as legitimate and key determinants of actions, experiences and successes in both transition to school and mathematics learning; and the belief that young children are powerful mathematics learners who can demonstrate this power as they start school. In each chapter, authors reflect on their work in the area of mathematics and transition to school, place that work within the overall context of research in these fields, predict the trajectory of this work in the future, and consider the implications of the work both theoretically and practically.

Transitions in Undergraduate Mathematics Education

In the last thirty years or so, the need to address the challenges of teaching and learning mathematics at university level has become increasingly appreciated by university mathematics teachers, and beyond, by educational institutions around the world. Indeed, mathematics is both a condition and an obstacle to success for students in many educational programmes vital to the 21st century knowledge society,

for example in pure and applied mathematics, engineering, natural sciences, technology, economics, finance, management and so on. This breadth of impact of mathematics implies the urgency of developing research in university mathematics education, and of sharing results of this research widely. This book provides a bespoke opportunity for an international audience of researchers in didactics of mathematics, mathematicians and any teacher or researcher with an interest in this area to be informed about state-of-the-art developments and to heed future research agendas. This book emerged from the activities of the research project INDRUM (acronym for International Network for Didactic Research in University Mathematics), which aims to contribute to the development of research in didactics of mathematics at all levels of tertiary education, with a particular concern for the development of early-career researchers in the field and for dialogue with university mathematicians. The aim of the book is to provide a deep synthesis of the research field as it appears through two INDRUM conferences organised in 2016 and 2018. It is an original contribution which highlights key research perspectives, addresses seminal theoretical and methodological issues and reports substantial results concerning the teaching and learning of mathematics at university level, including the teaching and learning of specific topics in advanced mathematics across a wide range of university programmes.

Mathematics and Transition to School

This topical survey focuses on research in tertiary mathematics education, a field that has experienced considerable growth over the last 10 years. Drawing on the most recent journal publications as well as the latest advances from recent high-quality conference proceedings, our review culls out the following five emergent areas of interest: mathematics teaching at the tertiary level; the role of mathematics in other disciplines; textbooks, assessment and students' studying practices; transition to the tertiary level; and theoretical-methodological advances. We conclude the survey with a discussion of some potential directions for future research in this new and rapidly evolving domain of inquiry.

Research and Development in University Mathematics Education

This book addresses the need of professional development leaders and policymakers for scholarly knowledge about influencing teachers to modify mathematical instruction to bring it more in alignment with the recommendations of the current reform movement initiated by the National Council of Teachers of Mathematics. The book presents: * theoretical perspectives for studying, analyzing, and understanding teacher change; * descriptions of contextual variables to be considered as one studies and attempts to understand teacher change; and * descriptions of professional development programs that resulted in teacher change. One chapter builds a rationale for looking to developmental psychology for guidance in constructing models of reconstructing new forms of mathematical instruction. Another highlights the relevance to mathematics teacher development of research-based knowledge about how children construct mathematical ideas. Other chapters explore the relationships between the various contexts of schooling and instructional change. Included also are chapters that describe and analyze major reform efforts designed to assist teachers in modifying their instructional practices (Cognitively Guided Instruction, Math-Cubed, Project Impact, Mathematics in Context, and the Case-Based Project). Finally, the current state of knowledge about encouraging teachers to modify their instruction is discussed, the implications of major research and implementation findings are suggested, and some of the major questions that need to be addressed are identified, such as what we have learned about teacher change.

Research on Teaching and Learning Mathematics at the Tertiary Level

This book considers the views of participants in the process of becoming a mathematician, that is, the students and the graduates. This book investigates the people who carry out mathematics rather than the topics of mathematics. Learning is about change in a person, the development of an identity and ways of interacting with the world. It investigates more generally the development of mathematical scientists for a variety of workplaces, and includes the experiences of those who were not successful in the transition to the workplace as mathematicians. The research presented is based on interviews, observations and surveys of students and graduates as they are finding their identity as a mathematician. The book contains material from the research carried out in South Africa, Northern Ireland, Canada and Brunei as well as Australia.

Mathematics Teachers in Transition

The driving forces behind mathematics learning trajectories is the need to understand how children actually learn and make sense of mathematics—how they progress from prior knowledge, through intermediate understandings, to the mathematics target understandings—and how to use these insights to improve instruction and student learning. In this book, readers will come to understand what learning trajectories are, the research and methodology that are necessary for developing them, and gain insight into potential applications of learning trajectories. A synthesis and research outcome in their own right, learning trajectories provide detailed description of instructionally-grounded development of mathematical concepts and reasoning from the perspective of student learning, and, overall, building on decades of accumulated experience in mathematics education research. However, their greater importance may lie in their potential as frameworks that contribute an unprecedented coherence across classroom instruction, professional development, standards, and assessment, by focusing squarely on conceptual understanding and reasoning instead of assessment-driven procedural knowledge. This potential was sufficiently compelling as an organizing framework to have been cited as a basis for the Common Core mathematics standards, the new mathematics learning expectations that are now consistent across most of the United States. (Among the conference attendees were the writers of the Common Core State Standards for Mathematics, at the beginning of the Standards drafting process.) This book is an outgrowth of a conference on learning trajectories, hosted in 2009 at North Carolina State University, which examined research on learning trajectories. An overarching message of the chapters in this volume is that learning trajectories, by focusing on how children's mathematical reasoning develops, are coming into their own as a rigorous underpinning for both instruction and accountability. Some of the learning scientists featured in this volume have played major roles learning trajectories' evolution--from small-scale day-to-day conjectures by individual teachers, to systematic research endeavors that teachers and scientists alike can use to interpret standards, plan instruction, and formatively assess student work. The work in this volume will be of interest to mathematics educators, teachers, and professional development specialists.

Becoming a Mathematician

As more schools begin to implement the National Science Education Standards, adults who care about the quality of K-12 science education in their communities may want to help their local schools make the transition. This booklet provides guidance to parents and others, explains why high-quality science education is important for all children and young adults, and shows how the quality of school science programs can be measured. Center for Science, Mathematics, and Engineering Education Staff; 1998, 32 pages, 8.5 x 11, single copy, \$10.00; 2-9 copies, \$7.00 each; 10 or more copies, \$4.50 each (no other discounts apply).

Learning Over Time

Gender Differences at Critical Transitions in the Careers of Science, Engineering, and Mathematics Faculty presents new and surprising findings about career differences between female and male full-time, tenure-track, and tenured faculty in science, engineering, and mathematics at the nation's top research universities. Much of this congressionally mandated book is based on two unique surveys of faculty and departments at major U.S. research universities in six fields: biology, chemistry, civil engineering, electrical engineering, mathematics, and physics. A departmental survey collected information on departmental policies, recent tenure and promotion cases, and recent hires in almost 500 departments. A faculty survey gathered information from a stratified, random sample of about 1,800 faculty on demographic characteristics, employment experiences, the allocation of institutional resources such as laboratory space, professional activities, and scholarly productivity. This book paints a timely picture of the status of female faculty at top universities, clarifies whether male and female faculty have similar opportunities to advance and succeed in academia, challenges some commonly held views, and poses several questions still in need of answers. This book will be of special interest to university administrators and faculty, graduate students, policy makers, professional and academic societies, federal funding agencies, and others concerned with the vitality of the U.S. research base and economy.

Every Child a Scientist

The diversity of research domains and theories in the field of mathematics education has been a permanent subject of discussions from the origins of the discipline up to the present. On the one hand the diversity is regarded as a resource for rich scientific development on the other hand it gives rise

to the often repeated criticism of the discipline's lack of focus and identity. As one way of focusing on core issues of the discipline the book seeks to open up a discussion about fundamental ideas in the field of mathematics education that permeate different research domains and perspectives. The book addresses transformation as one fundamental idea in mathematics education and examines it from different perspectives. Transformations are related to knowledge, related to signs and representations of mathematics, related to concepts and ideas, and related to instruments for the learning of mathematics. The book seeks to answer the following questions: What do we know about transformations in the different domains? What kinds of transformations are crucial? How is transformation in each case conceptualized?

Gender Differences at Critical Transitions in the Careers of Science, Engineering, and Mathematics Faculty

This book presents comprehensive results from case studies of three innovations in mathematics education that have much to offer toward understanding current reforms in this field. Each chapter tells the story of a case in rich detail, with extensive documentation, and in the voices of many of the participants—the innovators, the teachers, the students. Similarly, Volume 2 of *Bold Ventures* presents the results from case studies of five innovations in science education. Volume 1 provides a cross-case analysis of all eight innovations. Many U.S. readers certainly will be very familiar with the name of at least if not all of the mathematics innovations discussed in this volume—for one example, the NCTM Standards—and probably with their general substance. Much of the education community's familiarity with these" arises from the projects' own dissemination efforts. The research reported in this volume, however, is one of the few detailed studies of these innovations undertaken by researchers outside the projects themselves.

Transformation - A Fundamental Idea of Mathematics Education

Many in the mathematics community in the U.S. are involved in mathematics education in various capacities. This book highlights the breadth of the work in K-16 mathematics education done by members of US departments of mathematical sciences. It contains contributions by mathematicians and mathematics educators who do work in areas such as teacher education, quantitative literacy, informal education, writing and communication, social justice, outreach and mentoring, tactile learning, art and mathematics, ethnomathematics, scholarship of teaching and learning, and mathematics education research. Contributors describe their work, its impact, and how it is perceived and valued. In addition, there is a chapter, co-authored by two mathematicians who have become administrators, on the challenges of supporting, evaluating, and rewarding work in mathematics education in departments of mathematical sciences. This book is intended to inform the readership of the breadth of the work and to encourage discussion of its value in the mathematical community. The writing is expository, not technical, and should be accessible and informative to a diverse audience. The primary readership includes all those in departments of mathematical sciences in two or four year colleges and universities, and their administrators, as well as graduate students. Researchers in education may also find topics of interest. Other potential readers include those doing work in mathematics education in schools of education, and teachers of secondary or middle school mathematics as well as those involved in their professional development.

Bold Ventures

This edited volume presents a broad range of original practice-oriented research studies about tertiary mathematics education. These are based on current theoretical frameworks and on established and innovative empirical research methods. It provides a relevant overview of current research, along with being a valuable resource for researchers in tertiary mathematics education, including novices in the field. Its practice orientation research makes it attractive to university mathematics teachers interested in getting access to current ideas and results, including theory-based and empirically evaluated teaching and learning innovations. The content of the book is spread over 5 sections: The secondary-tertiary transition; University students' mathematical practices and mathematical inquiry; Research on teaching and curriculum design; University students' mathematical inquiry and Mathematics for non-specialists.

Mathematics Education

Would you like to understand more mathematics? Many people would. Perhaps at school you liked mathematics for a while but were then put off because you missed a key idea and kept getting

stuck. Perhaps you always liked mathematics but gave it up because your main interest was music or languages or science or philosophy. Or perhaps you studied mathematics to advanced levels, but have now forgotten most of what you once knew. Whichever is the case, this book is for you. It aims to build on what you know, revisiting basic ideas with a focus on meaning. Each chapter starts with an idea from school mathematics - often primary school mathematics - and gradually builds up a network of links to more advanced material. It explores fundamental ideas in depth, using insights from research in mathematics education and psychology to explain why people often get confused, and how to overcome that confusion. For nervous readers, it will build confidence by clarifying basic ideas. For more experienced readers, it will highlight new connections to more advanced material. Throughout, the book explains how mathematicians think, and how ordinary people can understand and enjoy mathematical ideas and arguments. If you would like to be better informed about the intrinsic elegance of mathematics, this engaging guide is the place to start.

Practice-Oriented Research in Tertiary Mathematics Education

As more schools begin to implement the National Science Education Standards, adults who care about the quality of K-12 science education in their communities may want to help their local schools make the transition. This booklet provides guidance to parents and others, explains why high-quality science education is important for all children and young adults, and shows how the quality of school science programs can be measured. Center for Science, Mathematics, and Engineering Education Staff; 1998, 32 pages, 8.5 x 11, single copy, \$10.00; 2-9 copies, \$7.00 each; 10 or more copies, \$4.50 each (no other discounts apply).

Mathematics Rebooted

Framed against the background of educational change, this book proposes to examine the relationship between curriculum change, teacher professional development, policy reform and the processes of educational change. The main aims of the book are to: (1) focus on educational changes and reconstruction in transitional societies that have undergone political, economic and social change in the past two decades, (2) provide a forum for the dissemination of research on education reconstruction and reform in transitional societies, (3) disseminate ideas that enhance both the practical and theoretical aspects of educational changes in these societies, (4) further knowledge and understanding of emerging trends and issues in education in these societies, (5) reflect the realities of educational scenarios in each transitional society. The book presents an in-depth exploration of educational reconstruction in 15 transitional societies. In each chapter, the authors have provided an overview of educational processes in the country, a distillation of education change or reform, and/or reconstruction in each transitional society. Collectively, the chapters in the book have attempted to contribute to a better understanding of the educational system in respective countries by identifying the challenges and obstacles, the policy implications, the teacher professional development needs and curriculum reform efforts.

Every Child a Scientist

Empower students to be the change—join the teaching mathematics for social justice movement! We live in an era in which students have—through various media and their lived experiences—a more visceral experience of social, economic, and environmental injustices. However, when people think of social justice, mathematics is rarely the first thing that comes to mind. Through model lessons developed by over 30 diverse contributors, this book brings seemingly abstract high school mathematics content to life by connecting it to the issues students see and want to change in the world. Along with expert guidance from the lead authors, the lessons in this book explain how to teach mathematics for self- and community-empowerment. It walks teachers step-by-step through the process of using mathematics—across all high school content domains—as a tool to explore, understand, and respond to issues of social injustice including: environmental injustice; wealth inequality; food insecurity; and gender, LGBTQ, and racial discrimination. This book features: Content cross-referenced by mathematical concept and social issues Downloadable instructional materials for student use User-friendly and logical interior design for daily use Guidance for designing and implementing social justice lessons driven by your own students' unique passions and challenges Timelier than ever, teaching mathematics through the lens of social justice will connect content to students' daily lives, fortify their mathematical understanding, and expose them to issues that will make them responsive citizens and leaders in the future.

Education Reform in Societies in Transition

The revised classic for designing mathematics and science professional development presents an updated planning framework and many professional development strategies and emphasizes continuous program monitoring and building professional cultures.

High School Mathematics Lessons to Explore, Understand, and Respond to Social Injustice

The author discusses how he began to bring new techniques into his middle school mathematics classroom, including using essays, journals, and other forms of writing, as well as assessment alternatives such as portfolios.

Designing Professional Development for Teachers of Science and Mathematics

This book comprises the Proceedings of the 12th International Congress on Mathematical Education (ICME-12), which was held at COEX in Seoul, Korea, from July 8th to 15th, 2012. ICME-12 brought together 3500 experts from 92 countries, working to understand all of the intellectual and attitudinal challenges in the subject of mathematics education as a multidisciplinary research and practice. This work aims to serve as a platform for deeper, more sensitive and more collaborative involvement of all major contributors towards educational improvement and in research on the nature of teaching and learning in mathematics education. It introduces the major activities of ICME-12 which have successfully contributed to the sustainable development of mathematics education across the world. The program provides food for thought and inspiration for practice for everyone with an interest in mathematics education and makes an essential reference for teacher educators, curriculum developers and researchers in mathematics education. The work includes the texts of the four plenary lectures and three plenary panels and reports of three survey groups, five National presentations, the abstracts of fifty one Regular lectures, reports of thirty seven Topic Study Groups and seventeen Discussion Groups.

Putting it Together

This book presents a carefully developed monitoring system to track the progress of mathematics and science education, particularly the effects of ongoing efforts to improve students' scientific knowledge and mathematics competency. It describes an improved series of indicators to assess student learning, curriculum quality, teaching effectiveness, student behavior, and financial and leadership support for mathematics and science education. Of special interest is a critical review of current testing methods and their use in probing higher-order skills and evaluating educational quality.

The Proceedings of the 12th International Congress on Mathematical Education

Students pursue problems they're curious about, not problems they're told to solve. Creating a math classroom filled with confident problem solvers starts with challenges discovered in the real world, not a sequence of prescribed problems. In this groundbreaking book, Gerald Aungst offers five powerful principles for instilling a culture of learning in your classroom: Conjecture, Collaboration, Communication, Chaos, and Celebration. Aungst shows how to: Embrace collaboration and purposeful chaos to engage students in productive struggle Put each chapter's principles into practice using a variety of strategies, activities, and technology tools Introduce lasting changes in your classroom through a gradual shift in processes and behaviors

Improving Indicators of the Quality of Science and Mathematics Education in Grades K-12

Today's undergraduate students--future leaders, policymakers, teachers, and citizens, as well as scientists and engineers--will need to make important decisions based on their understanding of scientific and technological concepts. However, many undergraduates in the United States do not study science, mathematics, engineering, or technology (SME&T) for more than one year, if at all. Additionally, many of the SME&T courses that students take are focused on one discipline and often do not give students an understanding about how disciplines are interconnected or relevant to students' lives and society. To address these issues, the National Research Council convened a series of symposia and forums of representatives from SME&T educational and industrial communities. Those discussions contributed to this book, which provides six vision statements and recommendations for how to improve SME&T education for all undergraduates. The book addresses pre-college preparation for students in SME&T and the joint roles and responsibilities of faculty and administrators in arts and sciences and

in schools of education to better educate teachers of K-12 mathematics, science, and technology. It suggests how colleges can improve and evaluate lower-division undergraduate courses for all students, strengthen institutional infrastructures to encourage quality teaching, and better prepare graduate students who will become future SME&T faculty.

5 Principles of the Modern Mathematics Classroom

"This book addresses the challenges that face science and mathematics education if it is to be relevant to 21st century citizens, as well as the ways that outstanding specialists from several countries around the world think it should deal with those challenges. Starting with the issue of science and mathematics teacher education in a changing world, it moves on to deal with innovative approaches to teaching science and mathematics. It then discusses contemporary issues related to the role played by technology in science and mathematics education, the challenges of the STEM agenda, and ways of making science and mathematics education more inclusive. Finally, it focuses on assessment issues, as the success of science and mathematics education depends at least in part on the purposes for which, and ways in which, students' learning is assessed. There is a worldwide trend towards providing meaningful science and mathematics education to all children for the sake of literacy and numeracy development and a need to produce enough science and technology specialists. This trend and need, coupled with the concern raised by students' disengagement in these two knowledge areas and the role that technology may play in countering it, put increasingly high demands on teachers. As shown in this book, science and mathematics education may offer a unique contribution in developing responsible citizens by fostering skills required in order to assume wider responsibilities and roles, focusing on personal, social and environmental dimensions. For instance, it offers unique insights into how teachers can build on students' complicated and interconnected real-worlds to help them learn authentic and relevant science and mathematics. Additionally, the book highlights potential positive relationships between science and mathematics, which are often envisaged as having a conflicting relationship in school curricula. By uncovering the similarities between them, and by providing evidence that both areas deal with issues that are relevant for citizens' daily lives, the book explores ways of linking and giving coherence to science and mathematics knowledge as components of everyday life settings. It also provides directions for future research on the educational potential of interconnecting science and mathematics at the different educational levels. Therefore, this is a worthwhile book for researchers, teacher educators and schoolteachers. It covers theoretical perspectives, research-based approaches and practical applications that may make a difference in education that is relevant and inclusive for citizens in the 21st century"--

Transforming Undergraduate Education in Science, Mathematics, Engineering, and Technology

The book focuses on the latest developments of the Anthropological Theory of the Didactic (ATD) and its links with other approaches in mathematics education. Leading researchers in the ATD and especially its creator, Yves Chevallard, present recent research results, theoretical advances and new methodologies in this approach, concerning critical educational problems at all levels. The book is addressed to researchers in mathematics education and all related fields, to teacher educators and teachers in primary, secondary and tertiary education interested in curriculum issues and research in didactics. The book includes four sections that correspond to four axes of current research in the framework of the ATD. The first one studies the relations between the ATD and other research frameworks. The second section focuses on the crucial role of didactics in teacher education, and the experiences carried out at different instructional levels. The third section addresses the curriculum problem in the historical transition from the classical paradigm of visiting works to the emerging didactic paradigm of questioning the world. The last section is about research in didactics at the university level, with investigations about the analysis of didactic transposition processes and the design and implementation of various instructional formats.

Science and Mathematics Education for 21st Century Citizens

This book brings together mathematics education research that makes a difference in both theory and practice - research that anticipates problems and needed knowledge before they become impediments to progress.

Becoming a Teacher in Mathematics and Science

Multicultural issues are part of the agenda for researchers, academics, and politicians. The new technologies have brought multiculturalism into our professional and personal lives, opening new possibilities for social interactions among people from different countries, cultures, ages, and gender. Being able to deal with diversity, including other cultures, is a must in the 21st century.

Advances in the Anthropological Theory of the Didactic

Amid current efforts to improve mathematics and science education in the United States, people often ask how these subjects are organized and taught in other countries. They hear repeatedly that other countries produce higher student achievement. Teachers and parents wonder about the answers to questions like these: Why do the children in Asian cultures seem to be so good at science and mathematics? How are biology and physics taught in the French curriculum? What are textbooks like elsewhere, and how much latitude do teachers have in the way they follow the texts? Do all students receive the same education, or are they grouped by ability or perceived educational promise? If students are grouped, how early is this done? What are tests like, and what are the consequences for students? Are other countries engaged in Standards-like reforms? Does anything like "standards" play a role in other countries? Questions such as these reflect more than a casual interest in other countries' educational practices. They grow out of an interest in identifying ways to improve mathematics and science education in the United States. The focus of this short report is on what the Third International Mathematics and Science Study (TIMSS), a major international investigation of curriculum, instruction, and learning in mathematics and science, will be able to contribute to understandings of mathematics and science education around the world as well as to current efforts to improve student learning, particularly in the United States.

Handbook of International Research in Mathematics Education

This is the first comprehensive book to consider STEM education from early childhood through to senior secondary education. It approaches STEM as a form of real-world, problem-based education that draws on the knowledge and skills of the science, technology, engineering and mathematics disciplines. Rather than presenting each of the separate disciplines to an equal extent, it focuses on STEM researchers' perspectives on how their work contributes to effective STEM education in terms of building knowledge, skills and engagement. Gathering contributions by authors from various countries, the book explores effective STEM education from a range of perspectives within the international context. Moreover, it addresses critical issues in STEM education, including transition and trajectories, gender, rurality, socioeconomic status and cultural diversity. By doing so, it not only shares the current state of knowledge in this field, but also offers a source of inspiration for future research.

Teaching in Transition

This volume brings together recent research and commentary in secondary school mathematics from a breadth of contemporary Canadian and International researchers and educators. It is both representative of mathematics education generally, as well as unique to the particular geography and culture of Canada. The chapters address topics of broad applicability such as technology in learning mathematics, recent interest in social justice contexts in the learning of mathematics, as well as Indigenous education. The voices of classroom practitioners, the group ultimately responsible for implementing this new vision of mathematics teaching and learning, are not forgotten. Each section includes a chapter written by a classroom teacher, making this volume unique in its approach. We have much to learn from one another, and this volume takes the stance that the development of a united vision, supported by both research and professional dialog, provides the first step.

Social Interactions in Multicultural Settings

This book discusses mathematics learners in transition and their practices in different contexts; the institutional and socio-cultural framing of the transition processes involved; and the communication and negotiation of mathematical meanings during transition. Providing both empirical studies and significant theoretical reflections, it will appeal to researchers and postgraduate students in mathematics education, cultural psychology, multicultural education, immigrant and indigenous education.

Mathematics and Science Education Around the World

This book includes 18 peer-reviewed papers from nine countries, originally presented in a shorter form at TSG 25 The Role of History of Mathematics in Mathematics Education, as part of ICME-13 during. It also features an introductory chapter, by its co-editors, on the structure and main points of the book with an outline of recent developments in exploring the role of history and epistemology in mathematics education. It serves as a valuable contribution in this domain, by making reports on recent developments in this field available to the international educational community, with a special focus on relevant research results since 2000. The 18 chapters of the book are divided into five interrelated parts that underlie the central issues of research in this domain: 1. Theoretical and conceptual frameworks for integrating history and epistemology in mathematics in mathematics education; 2. Courses and didactical material: Design, implementation and evaluation; 3. Empirical investigations on implementing history and epistemology in mathematics education; 4. Original historical sources in teaching and learning of and about mathematics; 5. History and epistemology of mathematics: Interdisciplinary teaching and sociocultural aspects. This book covers all levels of education, from primary school to tertiary education, with a particular focus on teacher education. Additionally, each chapter refers to and/or is based on empirical research, in order to support, illuminate, clarify and evaluate key issues, main questions, and conjectured theses raised by the authors or in the literature on the basis of historical-epistemological or didactical-cognitive arguments.

STEM Education Across the Learning Continuum

This book is based on a set of stories from teachers and education professionals in thirteen OECD countries. Twenty-three case studies tell of innovations in practice involving school teachers, inspectors, academics and policy makers.

Teaching and Learning Secondary School Mathematics

Argues that teachers and schools should create hybrid third spaces--neither classroom nor home--in which underserved students can merge their personal worlds with those of math and science.

Transitions Between Contexts of Mathematical Practices

The Encyclopedia of Mathematics Education is a comprehensive reference text, covering every topic in the field with entries ranging from short descriptions to much longer pieces where the topic warrants more elaboration. The entries provide access to theories and to research in the area and refer to the leading publications for further reading. The Encyclopedia is aimed at graduate students, researchers, curriculum developers, policy makers, and others with interests in the field of mathematics education. It is planned to be 700 pages in length in its hard copy form but the text will subsequently be up-dated and developed on-line in a way that retains the integrity of the ideas, the responsibility for which will be in the hands of the Editor-in-Chief and the Editorial Board. This second edition will include additional entries on: new ideas in the politics of mathematics education, working with minority students, mathematics and art, other cross-disciplinary studies, studies in emotions and mathematics, new frameworks for analysis of mathematics classrooms, and using simulations in mathematics teacher education. Existing entries will be revised and new entries written. Members of the international mathematics education research community will be invited to propose new entries. Editorial Board: Bharath Sriraman Melony Graven Yoshinori Shimizu Ruhama Even Michele Artigue Eva Jablonka Wish to Become an Author? Springer's Encyclopedia of Mathematics Education's first edition was published in 2014. The Encyclopedia is a "living" project and will continue to accept articles online as part of an eventual second edition. Articles will be peer-reviewed in a timely manner and, if found acceptable, will be immediately published online. Suggested articles are, of course, welcome. Feel encouraged to think about additional topics that we overlooked the first time around, and to suggest colleagues (including yourself!) who will want to write them. Interested new authors should contact the editor in chief, Stephen Lerman, at lermans@lsbu.ac.uk, for more specific instructions.

Mathematics, Education and History

Changing the Subject