


Fundamental Constructs in Mathematics Education

**Edited by John Mason and
Sue Johnston-Wilder**

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Fundamental Constructs In Mathematics Education Researching Mathematics Learning S

Julie Sarama, Douglas H. Clements



Fundamental Constructs In Mathematics Education Researching Mathematics Learning S:

Fundamental Constructs in Mathematics Education John Mason, Sue Johnston-Wilder, 2004 This book brings together a collection of classic tasks extracts and texts that have been quoted repeatedly in mathematics education literature

Fundamental Constructs in Mathematics Education Sue Johnston-Wilder, John Mason, 2004-01-22 Fundamental Constructs in Mathematics Education is a unique sourcebook which has been crafted from a collection of classic tasks extracts and texts that have been quoted repeatedly in mathematics education literature Linked together by the editors narrative the book provides a fascinating examination of key constructs in mathematics education The book is divided into two parts The first part examines thinking about the learner and includes the following constructs constructivisms activity theory and didactics Beginning with a chapter dedicated to the classic tasks used by researchers to probe learners understanding readers are encouraged to try these theories themselves with learners and be knowledgeable when they encounter them in other writing The second part focuses on thinking and teaching and includes issues of getting started keeping going and bringing to a conclusion Bringing together writing from Balacheff Brousseau Bruner Cobb Comfrey Freudenthal Greeno Marton Piaget Schon Vygotsky and many others this unique examination of constructs in mathematics education will be a valuable resource for anyone reading literature related to learning mathematics be they a teacher adviser or a student on a masters or PhD course

Handbook of International Research in Mathematics Education Lyn D. English, David Kirshner, 2015-07-30 This third edition of the Handbook of International Research in Mathematics Education provides a comprehensive overview of the most recent theoretical and practical developments in the field of mathematics education Authored by an array of internationally recognized scholars and edited by Lyn English and David Kirshner this collection brings together overviews and advances in mathematics education research spanning established and emerging topics diverse workplace and school environments and globally representative research priorities New perspectives are presented on a range of critical topics including embodied learning the theory practice divide new developments in the early years educating future mathematics education professors problem solving in a 21st century curriculum culture and mathematics learning complex systems critical analysis of design based research multimodal technologies and e textbooks Comprised of 12 revised and 17 new chapters this edition extends the Handbook s original themes for international research in mathematics education and remains in the process a definitive resource for the field

Learning to Teach Mathematics in the Secondary School Sue Johnston-Wilder, Clare Lee, David Pimm, 2010-09-13 What is the role of mathematics in the secondary classroom What is expected of a would be maths teacher How is mathematics best taught and learnt Learning to Teach Mathematics in the Secondary School combines theory and practice to present a broad introduction to the opportunities and challenges of teaching mathematics in the modern secondary school classroom Written specifically with the new and student teacher in mind the book covers a wide range of issues related to the teaching of mathematics

including The role of ICT Assessment for Learning NEW Using mathematics in context NEW Communicating mathematically Planning mathematics lessons Including special needs pupils Teaching mathematics post 16 Professional Development Already a major text for many university teaching courses this fully revised third edition takes into account new developments in the National Curriculum as well as recent changes to the standards for Qualified Teacher Status Featuring two brand new chapters a glossary of useful terms addresses for resources and organisations and tasks designed to prompt critical reflection and support thinking and writing at Masters level this book will help you make the most of school experience during your training and beyond Designed for use as a core textbook this new edition of Learning to Teach Mathematics in the Secondary School provides essential guidance and advice for all trainee and practising teachers of secondary mathematics

EBOOK: Teaching Adult Numeracy: Principles & Practice Graham Griffiths, Rachel Stone, 2013-09-16 This book offers friendly guidance on how to work with adult learners to develop their numeracy and mathematics skills It brings together current research and practice on teaching adult numeracy into one handy volume and covers the major issues faced by teachers of adult numeracy such as current policy perspectives and implications for teaching practice There are reflective tasks throughout which encourage you to develop and apply your theoretical knowledge to your own experiences Key features include Reviews of existing policy and research and implications for practice Reflective tasks with commentary encouraging you to develop and apply your knowledge Case studies of real student experiences Practical activities and ideas to support the planning teaching and assessment of adult numeracy Drawing on the substantial experience of the contributors who have a wealth of experience as practitioners and researchers in the field this book is an essential resource for trainee and practising teachers of adult numeracy and mathematics It is also an ideal textbook to support teacher training courses leading to a subject specific qualification in teaching numeracy to adults Contributors Jackie Ashton John Barton Carolyn Brooks Martyn Edwards Janette Gibney David Holloway David Kaye Beth Kelly Barbara Newmarch Helen Oughton David Prinn Diana Spurr Rebecca Woolley This is a quite unique book about teaching adult numeracy which will be invaluable to the many practitioners in this field The chapters contributed by a group of experienced and successful lecturers and practitioners include all aspects of this field from methods of teaching specific mathematical topics to more general explorations of dyscalculia and emotional factors in adult learners Each chapter includes research findings and thoughtful presentation of ideas with practical ideas for teaching and tasks for the reader This is a market which has not been served well in the past so it is good to see the gap filled at last Margaret Brown Emeritus Professor of Mathematics Education King's College London UK The editors of this book set out to produce a text that would support teacher education programmes for adult numeracy and their book does that and more The content covers different types of learners different settings different understandings of what numeracy actually is and ranges from commentary on research through case studies to how to hints and tips for teaching Chapters 7 on provoking mathematical thinking and 8

attitudes beliefs and teaching should be a required read for any adult numeracy teacher The book would be at home on any numeracy teacher s desk and would make an excellent set text for numeracy teacher training courses Carol Randall course co ordinator for numeracy in the department of Lifelong Learning Teacher Education University of Greenwich UK This book is a welcome addition to the growing literature on adult numeracy It should be essential reading for trainee and practising adult numeracy educators It brings together relevant research and professional wisdom on a wide variety of aspects of adult numeracy teaching and learning in an accessible way with well focussed tasks for readers to extend their knowledge and understanding While the book is born out of UK concerns and issues it is also relevant to international readers Highly recommended Professor Diana Coben PhD Director National Centre of Literacy Numeracy for Adults University of Waikato New Zealand and Hon Trustee Adults Learning Mathematics A Research Forum ALM www.alm.online.net **Mathematical**

Tasks: The Bridge Between Teaching and Learning Chris McGrane, Mark McCourt, 2020-10-01 If we want our pupils to develop fluency understanding and the ability to solve complex problems then it is vital that teachers develop the ability to select adapt and design appropriate mathematical tasks In **Mathematical Tasks The Bridge Between Teaching and Learning** Chris McGrane and Mark McCourt a range of practical approaches strategies and principles behind the design and effective use of tasks in the mathematics classroom that lead to all pupils becoming successful learners First hand interviews with world class mathematics education experts and practicing teachers bring to life the ideas behind how tasks can act as a bridge between what the teacher wants the pupil to make sense of and what the pupil actually does makes sense of tasks are how we enable pupils to enact mathematics it is only by being mathematical that pupils can truly make connections across mathematical ideas and understand the bigger picture This is a book for classroom teachers Chris McGrane offers a range of practical examples for nurturing deep learning in mathematics that can be adapted and embedded in one s own classroom practice This is also a book for those who are interested in the theory behind tasks Chris and his interviewees examine the key role tasks play in shaping learning teaching curriculum and assessment Suitable for teachers at all stages in their careers and teachers are encouraged to return to the book from time to time over the years to notice how their use of tasks in the classroom changes as they themselves develop **Problem Solving in Mathematics Instruction and Teacher Professional Development**

Patricio Felmer, Peter Liljedahl, Boris Koichu, 2019-11-22 Recent research in problem solving has shifted its focus to actual classroom implementation and what is really going on during problem solving when it is used regularly in classroom This book seeks to stay on top of that trend by approaching diverse aspects of current problem solving research covering three broad themes Firstly it explores the role of teachers in problem solving classrooms and their professional development moving onto secondly the role of students when solving problems with particular consideration of factors like group work discussion role of students in discussions and the effect of students engagement on their self perception and their view of mathematics Finally the book considers the question of problem solving in mathematics instruction as it

overlaps with problem design problem solving situations and actual classroom implementation The volume brings together diverse contributors from a variety of countries and with wide and varied experiences combining the voices of leading and developing researchers The book will be of interest to any reader keeping on the frontiers of research in problem solving more specifically researchers and graduate students in mathematics education researchers in problem solving as well as teachers and practitioners

Fourth International Handbook of Mathematics Education M.A. (Ken) Clements, Berinderjeet Kaur, Thomas Lowrie, Vilma Mesa, Johan Prytz, 2024-11-19 This fourth international handbook discusses developments not recognized or dealt with fully in the first three Springer Mathematics Education handbooks and tackles controversial issues in the field After starting with a provocative introductory chapter which asks whether controversy is a healthy feature of international mathematics education the four following sections cover a mathematics education in Asia b the roles of theory in research and practice c equity and social justice and d curriculum and change These themes are taken up in 28 chapters by 60 authoritative authors from all continents Each of the four sections is structured on the basis of past present and future aspects Like the first three mathematics education handbooks this handbook provides a very valuable resource for teachers mathematics education practitioners and researchers education policy makers and mathematicians as well as graduate and undergraduate students

Early Childhood Mathematics Education Research Julie Sarama, Douglas H.

Clements, 2009-04-01 This important new book synthesizes relevant research on the learning of mathematics from birth into the primary grades from the full range of these complementary perspectives At the core of early math experts Julie Sarama and Douglas Clements's theoretical and empirical frameworks are learning trajectories detailed descriptions of children's thinking as they learn to achieve specific goals in a mathematical domain alongside a related set of instructional tasks designed to engender those mental processes and move children through a developmental progression of levels of thinking Rooted in basic issues of thinking learning and teaching this groundbreaking body of research illuminates foundational topics on the learning of mathematics with practical and theoretical implications for all ages Those implications are especially important in addressing equity concerns as understanding the level of thinking of the class and the individuals within it is key in serving the needs of all children

Mathematical Encounters and Pedagogical Detours Boris Koichu, Rina Zazkis, 2021-02-04 This book explores the idea that mathematics educators and teachers are also problem solvers and learners and as such they constantly experience mathematical and pedagogical disturbances Accordingly many original tasks and learning activities are results of personal mathematical and pedagogical disturbances of their designers who then transpose these disturbances into learning opportunities for their students This learning transposition process is a cornerstone of mathematics teacher education as a lived developing enterprise Mathematical Encounters and Pedagogical Detours unfold the process and illustrate it by various examples The book engages readers in original tasks shares the results of task implementation and describes how these results inform the development of new tasks which often intertwine

mathematics and pedagogy Most importantly the book includes a dialogue between the authors based on the stories of their own learning which triggers continuous exploration of learning opportunities for their students *Writing in the Disciplines* Mary Deane, Peter O'Neill, 2011-08-23 Writing in the Disciplines WiD is a growing field in which discipline based academics writing developers and learning technologists collaborate to help students succeed as subject specialists This book places WiD in its theoretical and cultural contexts and reports on initiatives taking place at a range of UK higher education institutions Also includes surveys of current developments and scholarship in the US Australia Europe and elsewhere making it of interest to both a UK and an international audience Mathematics Education with Digital Technology Adrian

Oldknow, 2011-06-02 Mathematics Education with Digital Technology examines ways in which widely available digital technologies can be used to benefit the teaching and learning of mathematics The contributors offer their insights to locate the value of digital technology for mathematics learning within the context of evidence from documented practice prior research and of educational policy making Key pedagogical uses of digital technologies are evaluated in relation to effective mathematics learning and practical ideas for teaching and learning mathematics with digital technology are critically analysed The volume concludes by looking at future developments and by considering the ways in which ICT could be used as a catalyst for cross curricular work to achieve greater curricular coherence **Engaging (with) Mathematics and**

Learning to Teach. An Integrated Approach to Mathematics Preservice Education Hilary Povey, 2017-07-31

Mathematics education research indicates the value of a meaning making and problem solving approach to the teaching mathematics in primary and lower secondary classrooms Yet teachers most of whom have not experienced such pedagogies in their own mathematics learning often find it difficult to implement such approaches Based on over twenty five years in mathematics preservice education this book is intended to support preservice tutors and their students in bridging this gap The book takes six topics from the primary and lower secondary curriculum place value number systems the four rules of number polygons their properties and their symmetries natural numbers including factors multiples powers and simple number theory fractions decimals and irrational numbers and polyhedra Each topic is located very briefly in the research literature and its place in or linked to the primary and lower secondary curriculum is discussed Relevant mathematical activities follow many of which can transfer directly from the university to the school classroom with very little adaptation The final topic chapter is rather different It deals with group theory an aspect of mathematics which is related to primary and lower secondary mathematics structurally but not in terms of recognisable content There is an emphasis throughout on the need to reflect on mathematical experience to develop sensitivity and self awareness and to promote an approach to the subject that is creative and inclusive *Teaching and Learning Algebraic Thinking with 5- to 12-Year-Olds* Carolyn

Kieran, 2017-12-04 This book highlights new developments in the teaching and learning of algebraic thinking with 5 to 12 year olds Based on empirical findings gathered in several countries on five continents it provides a wealth of best practices

for teaching early algebra Building on the work of the ICME 13 International Congress on Mathematical Education Topic Study Group 10 on Early Algebra well known authors such as Luis Radford John Mason Maria Blanton Deborah Schifter and Max Stephens as well as younger scholars from Asia Europe South Africa the Americas Australia and New Zealand present novel theoretical perspectives and their latest findings The book is divided into three parts that focus on i epistemological mathematical aspects of algebraic thinking ii learning and iii teaching and teacher development Some of the main threads running through the book are the various ways in which structures can express themselves in children s developing algebraic thinking the roles of generalization and natural language and the emergence of symbolism Presenting vital new data from international contexts the book provides additional support for the position that essential ways of thinking algebraically need to be intentionally fostered in instruction from the earliest grades

The Future of Educational Research Noleine Fitzallen, Robyn Reaburn, Si Fan, 2014-04-03 The Future of Educational Research Perspectives from Beginning Researchers provides a snapshot of research across a diversity of fields in education conducted by beginning researchers The five main sections of the book cover research into policy and curriculum teachers experiences educational technologies the teaching and learning of mathematics and literacy development The chapters make valuable contributions to knowledge of contemporary issues in education They illustrate research topics and methodologies that will underpin and provoke future research and demonstrate the potential of these beginning researchers to become leaders in their chosen fields of educational research The chapters also demonstrate the breadth of research topics being undertaken in educational research today For supervisors and research higher degree students the book provides samples of research higher degree student writing that not only exemplify approaches to presenting research but also support the value of publication at all stages of study

Mathematical Knowledge in Teaching Tim Rowland, Kenneth Ruthven, 2011-01-06 The quality of primary and secondary school mathematics teaching is generally agreed to depend crucially on the subject related knowledge of the teacher However there is increasing recognition that effective teaching calls for distinctive forms of subject related knowledge and thinking Thus established ways of conceptualizing developing and assessing mathematical knowledge for teaching may be less than adequate These are important issues for policy and practice because of longstanding difficulties in recruiting teachers who are confident and conventionally well qualified in mathematics and because of rising concern that teaching of the subject has not adapted sufficiently The issues to be examined in Mathematical Knowledge in Teaching are of considerable significance in addressing global aspirations to raise standards of teaching and learning in mathematics by developing more effective approaches to characterizing assessing and developing mathematical knowledge for teaching

University Science and Mathematics Education in Transition Ole Skovsmose, Paola Valero, Ole Ravn Christensen, 2008-11-19 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 *Foundations for the Future in Mathematics Education* Richard A. Lesh, Eric Hamilton, James J.

Kaput, 2020-10-07 The central question addressed in *Foundations for the Future in Mathematics Education* is this What kind of understandings and abilities should be emphasized to decrease mismatches between the narrow band of mathematical understandings and abilities that are emphasized in mathematics classrooms and tests and those that are needed for success beyond school in the 21st century This is an urgent question In fields ranging from aeronautical engineering to agriculture and from biotechnologies to business administration outside advisors to future oriented university programs increasingly emphasize the fact that beyond school the nature of problem solving activities has changed dramatically during the past twenty years as powerful tools for computation conceptualization and communication have led to fundamental changes in the levels and types of mathematical understandings and abilities that are needed for success in such fields For K 12 students and teachers questions about the changing nature of mathematics and mathematical thinking beyond school might be rephrased to ask If the goal is to create a mathematics curriculum that will be adequate to prepare students for informed citizenship as well as preparing them for career opportunities in learning organizations in knowledge economies in an age of increasing globalization how should traditional conceptions of the 3Rs be extended or reconceived Overall this book suggests that it is not enough to simply make incremental changes in the existing curriculum whose traditions developed out of the needs of industrial societies The authors beyond simply stating conclusions from their research use results from it to describe promising directions for a research agenda related to this question The volume is organized in three sections Part I focuses on naturalistic observations aimed at clarifying what kind of mathematical thinking people really do when they are engaged in real life problem solving or decision making situations beyond school Part II shifts attention toward changes that have occurred in kinds of elementary but powerful mathematical concepts topics and tools that have evolved recently and that could replace past notions of basics by providing new foundations for the future This section also initiates discussions about what it means to understand the preceding ideas and abilities Part III extends these discussions about meaning and understanding and emphasizes teaching experiments aimed at investigating how instructional activities can be designed to facilitate the development of the preceding ideas and abilities *Foundations for the Future in Mathematics Education* is an essential reference for researchers curriculum developers assessment experts and teacher educators across the fields of mathematics and science education **Building the Foundation: Whole Numbers in the Primary Grades** Maria G.

Bartolini Bussi, Xu Hua Sun, 2018-03-29 This twenty third ICMI Study addresses for the first time mathematics teaching and learning in the primary school and pre school setting while also taking international perspectives socio cultural diversity and institutional constraints into account One of the main challenges of designing the first ICMI primary school study of this kind is the complex nature of mathematics at the early level Accordingly a focus area that is central to the discussion was chosen

together with a number of related questions The broad area of Whole Number Arithmetic WNA including operations and relations and arithmetic word problems forms the core content of all primary mathematics curricula The study of this core content area is often regarded as foundational for later mathematics learning However the principles and main goals of instruction on the foundational concepts and skills in WNA are far from universally agreed upon and practice varies substantially from country to country As such this study presents a meta level analysis and synthesis of what is currently known about WNA providing a useful base from which to gauge gaps and shortcomings as well as an opportunity to learn from the practices of different countries and contexts

An A-Z of Creative Teaching in Higher Education Sylvia Ashton,Rachel Stone,2021-03-31 HE students rightly have high expectations of their lecturers and tutors As staff in HE adapt their teaching to fit the changing share of HE more support is needed This A Z guide is an essential resource to support those teaching in HE today to enhance their practice This text is a rich source of innovative approaches for learning and teaching in HE It addresses some common issues faced by lecturers in HE and includes case studies and practical suggestions for teaching The text takes a critical approach to exploring themes from different perspectives and highlights important and recent theory in the field This second edition includes more content on teaching and learning online a new chapter on decolonising the curriculum and many more updates throughout

Fundamental Constructs In Mathematics Education Researching Mathematics Learning S Book Review: Unveiling the Magic of Language

In an electronic era where connections and knowledge reign supreme, the enchanting power of language has become much more apparent than ever. Its power to stir emotions, provoke thought, and instigate transformation is really remarkable. This extraordinary book, aptly titled "**Fundamental Constructs In Mathematics Education Researching Mathematics Learning S**," published by a highly acclaimed author, immerses readers in a captivating exploration of the significance of language and its profound impact on our existence. Throughout this critique, we shall delve into the book's central themes, evaluate its unique writing style, and assess its overall influence on its readership.

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