

THE PHILOSOPHY OF MATHEMATICS EDUCATION: AN OVERVIEW¹

Paul Ernest

ABSTRACT

This chapter offers an overview of the philosophy of mathematics education. This sub-field is characterised in both narrow and broad terms, concerning the aims of mathematics education and all philosophical aspects of research in mathematics education, respectively. The sub-field is also explored in terms of its questions and practices, which can be called a bottom-up perspective, as well as in terms of the applications of branches of philosophy to mathematics education, which might be called a top-down perspective. From the bottom-up one can characterize the area in terms of questions, and I have asked: What are the aims and purposes of teaching and learning mathematics? What is mathematics? How does mathematics relate to society? What is learning mathematics? What is mathematics teaching? What is the status of mathematics education as knowledge field? In characterizing the sub-field from a 'top down' perspective I look briefly at the contributions of ontology and metaphysics, aesthetics, epistemology and learning theory, social philosophy, ethics, and the research methodology of mathematics education. This reveals both how rich and deep the contributions of philosophy are to the theoretical foundations of our field of study. But even these different approaches leave many questions unanswered. For example: what are the responsibilities of mathematics and what is the responsibility of our own subfield, the philosophy of mathematics education? I conclude that the role of the philosophy of mathematics education is to analyse, question, challenge, and critique the claims of mathematics education practice, policy and research.

INTRODUCTION: WHAT IS THE PHILOSOPHY OF MATHEMATICS EDUCATION?

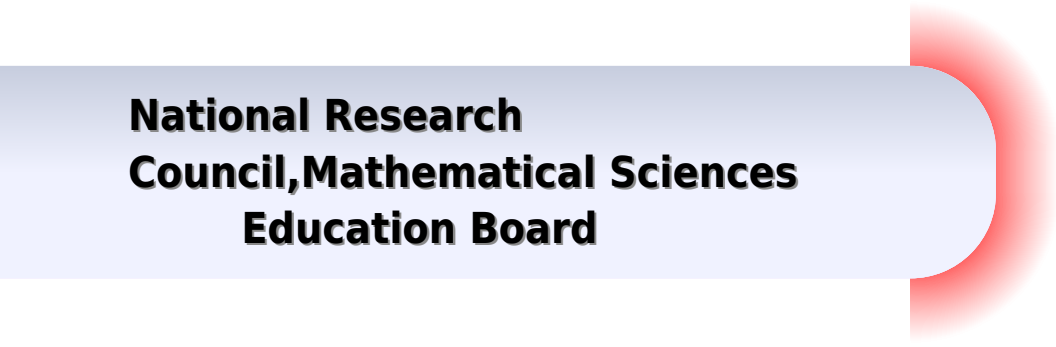
In the past quarter century the philosophy of mathematics education has emerged as a loosely defined area of research, primarily concerned with the philosophical aspects of mathematics education. This chapter aims to briefly map out some of its terrain, and attempt a synoptic vision of the breadth and depth of this area. This will prepare the ground for the more detailed and specific enquiries in the chapters that follow. This task is made all the more urgent as the question of what constitutes the philosophy of mathematics education is not without ambiguity and multiple answers. For example, is the philosophy of mathematics education a particular, specific approach to mathematics teaching and learning or to mathematics education research? The definite article might be taken to imply a claim for the definitiveness of the account, namely, that a unique philosophy, rationale or direction is proposed. This is not what is intended here, and 'the' is meant to indicate a definite area of enquiry, a specific domain, not a single fixed ideological perspective. Thus, *the* philosophy of mathematics education is not a dominant interpretation but rather a particular, if not completely defined, area of study and investigation, a sub-specialism within mathematics education.

¹

This is a draft of the chapter: Paul Ernest, *The Philosophy of Mathematics Education: An Overview*. In Paul Ernest (Ed.) *The Philosophy of Mathematics Education Today*, Springer, 2018, Pages 13-37. <https://link.springer.com/book/10.1007/978-3-319-72760-3>

Mathematics Education And Philosophy

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Mathematics Education And Philosophy:

Mathematics Education and Philosophy Paul Ernest, 2003-09-02 Currently there is a great deal of interest in philosophical issues in the teaching and learning of both mathematics and science education In this book Ernest has collected together papers from the foremost researchers and practitioners in the philosophy of mathematics education and related areas together with a selection of papers from the International Congress of Mathematics Education held in Quebec in 1992 Throughout the outstanding feature of the collection is its multidisciplinary approach to the field of study This book is the second in Paul Ernest's Studies in Mathematics Education series

The Philosophy of Mathematics Education Paul Ernest, 2002-11-01 Although many agree that all teaching rests on a theory of knowledge there has been no in depth exploration of the implications of the philosophy of mathematics for education This is Paul Ernest's aim Building on the work of Lakatos and Wittgenstein it challenges the prevalent notion that mathematical knowledge is certain absolute and neutral and offers instead an account of mathematics as a social construction This has profound educational implications for social issues including gender race and multiculturalism for pedagogy including investigations and problem solving and challenges hierarchical views of mathematics learning and ability Beyond this the book offers a well grounded model of five educational ideologies each with its own epistemology values aims and social group of adherents An analysis of the impact of these groups on the National Curriculum results in a powerful critique revealing the questionable assumptions values and interests upon which it rests The book finishes on an optimistic note arguing that pedagogy left unspecified by the National Curriculum is the way to achieve the radical aims of educating confident problem posers and solvers who are able to critically evaluate the social uses of mathematics

Philosophical Dimensions in Mathematics Education Karen Francois, Jean Paul Van Bendegem, 2007-11-15 This book brings together diverse recent developments exploring philosophy of mathematics in education The unique combination of ethnomathematics philosophy history education statistics and mathematics offers a variety of different perspectives from which existing boundaries in mathematics education can be extended The ten chapters in this book offer a balance between philosophy of and philosophy in mathematics education Attention is paid to the implementation of a philosophy of mathematics within the mathematics curriculum to become a philosophy in mathematics education In doing so many chapters provide ideas for actual practice and some practical examples directly usable in teacher training and in mathematics classrooms

Towards a Philosophy of Critical Mathematics Education Ole Skovsmose, 2013-03-09 In Nineteen Eighty Four George Orwell gives a description of different forms of suppression We learn about the telescreens placed everywhere through which it is possible for Big Brother to watch the inhabitants of Oceania However it is not only important to control the activities of the inhabitants it is important as well to control their thoughts and the Thought Police are on guard This is a very direct form of monitoring and control but Orwell also outlines a more imperceptible and calculated line of thought control In the Appendix to Nineteen Eighty Four Orwell

explains some structures of Newspeak which is going to become the official language of Oceania Newspeak is being developed by the Ministry of Truth and this language has to substitute Oldspeak similar to standard English Newspeak should fit with the official politics of Oceania ruled by the Ingsoc party The purpose of Newspeak was not only to provide a medium of expression for the world view and mental habits proper to the devotees of Ingsoc but to make all other modes of thought impossible It was intended that when Newspeak had been adopted once and for all and Oldspeak forgotten a heretical thought that is a thought diverging from the principles of Ingsoc should be literally unthinkable at least as far as thought is dependent on words

The Philosophy of Mathematics Education Today Paul Ernest, 2018-06-09 This book offers an up to date overview of the research on philosophy of mathematics education one of the most important and relevant areas of theory The contributions analyse question challenge and critique the claims of mathematics education practice policy theory and research offering ways forward for new and better solutions The book poses basic questions including What are our aims of teaching and learning mathematics What is mathematics anyway How is mathematics related to society in the 21st century How do students learn mathematics What have we learnt about mathematics teaching Applied philosophy can help to answer these and other fundamental questions and only through an in depth analysis can the practice of the teaching and learning of mathematics be improved The book addresses important themes such as critical mathematics education the traditional role of mathematics in schools during the current unprecedented political social and environmental crises and the way in which the teaching and learning of mathematics can better serve social justice and make the world a better place for the future

Philosophy of Mathematics Education, *Ongoing Advancements in Philosophy of Mathematics Education* Maria Aparecida Viggiani Bicudo, Bronislaw Czarnocha, Maurício Rosa, Małgorzata Marciniak, 2023-09-30 Ongoing Advancements in Philosophy of Mathematics Education approaches the philosophy of mathematics education in a forward movement analyzing reflecting and proposing significant contemporary themes in the field of mathematics education The theme that gives life to the book is philosophy of mathematics education understood as arising from the intertwining between philosophy of mathematics and philosophy of education which through constant analytical and reflective work regarding teaching and learning practices in mathematics is materialized in its own discipline philosophy of mathematics education This is the field of investigation of the chapters in the book The chapters are written by an international cohort of authors from a variety of countries regions and continents Some of these authors work with philosophical and psychological foundations traditionally accepted by Western civilization Others expose theoretical foundations based on a new vision and comprising innovative approaches to historical and present day issues in educational philosophy The final third of the book is devoted to these unique and innovative research stances towards important and change resistant societal topics such as racism technology gaps or the promotion of creativity in the field of mathematics education

The Philosophy of Mathematics Education Paul Ernest, Ole Skovsmose, Jean Paul van Bendegem, Maria Bicudo, Roger Miarka, Ladislav

Kvasz, Regina Moeller, 2016-08-04 This survey provides a brief and selective overview of research in the philosophy of mathematics education It asks what makes up the philosophy of mathematics education what it means what questions it asks and answers and what is its overall importance and use It provides overviews of critical mathematics education and the most relevant modern movements in the philosophy of mathematics A case study is provided of an emerging research tradition in one country This is the Hermeneutic strand of research in the philosophy of mathematics education in Brazil This illustrates one orientation towards research inquiry in the philosophy of mathematics education It is part of a broader practice of philosophical archaeology the uncovering of hidden assumptions and buried ideologies within the concepts and methods of research and practice in mathematics education An extensive bibliography is also included **Mathematics, Education and Philosophy ...**, 1994 **Social Constructivism as a Philosophy of Mathematics** Paul Ernest, 1997-11-20 Proposing social constructivism as a novel philosophy of mathematics this book is inspired by current work in sociology of knowledge and social studies of science It extends the ideas of social constructivism to the philosophy of mathematics developing a whole set of new notions The outcome is a powerful critique of traditional absolutist conceptions of mathematics as well as of the field of philosophy of mathematics itself Proposed are a reconceptualization of the philosophy of mathematics and a new set of adequacy criteria The book offers novel analyses of the important but under recognized contributions of Wittgenstein and Lakatos to the philosophy of mathematics Building on their ideas it develops a theory of mathematical knowledge and its relation to the social context It offers an original theory of mathematical knowledge based on the concept of conversation and develops the rhetoric of mathematics to account for proof in mathematics Another novel feature is the account of the social construction of subjective knowledge which relates the learning of mathematics to philosophy of mathematics via the development of the individual mathematician It concludes by considering the values of mathematics and its social responsibility *Perspectives on Mathematical Practices* Bart van Kerkhove, Jean Paul Van Bendegem, 2007-06-01 Philosophy of mathematics today has transformed into a very complex network of diverse ideas viewpoints and theories Sometimes the emphasis is on the classical foundational work often connected with the use of formal logical methods sometimes on the sociological dimension of the mathematical research community and the products it produces then again on the education of future mathematicians and the problem of how knowledge is or should be transmitted from one generation to the next The editors of this book felt the urge first of all to bring together the widest variety of authors from these different domains and secondly to show that this diversity does not exclude a sufficient number of common elements to be present In the eyes of the editors this book will be considered a success if it can convince its readers of the following that it is warranted to dream of a realistic and full fledged theory of mathematical practices in the plural If such a theory is possible it would mean that a number of presently existing fierce oppositions between philosophers sociologists educators and other parties involved are in fact illusory Math Worlds Sal Restivo, Jean Paul Van Bendegem, Roland Fischer, 1993-03-24 An international group of

distinguished scholars brings a variety of resources to bear on the major issues in the study and teaching of mathematics and on the problem of understanding mathematics as a cultural and social phenomenon All are guided by the notion that our understanding of mathematical knowledge must be grounded in and reflect the realities of mathematical practice Chapters on the philosophy of mathematics illustrate the growing influence of a pragmatic view in a field traditionally dominated by platonic perspectives In a section on mathematics politics and pedagogy the emphasis is on politics and values in mathematics education Issues addressed include gender and mathematics applied mathematics and social concerns and the reflective and dialogical nature of mathematical knowledge The concluding section deals with the history and sociology of mathematics and with mathematics and social change Contributors include Philip J Davis Helga Jungwirth Nel Noddings Yehuda Rav Michael D Resnik Ole Skovsmose and Thomas Tymoczko Philosophical Dimensions in Mathematics Education Karen Francois, Jean Paul Van Bendegem, 2008-11-01 This book brings together diverse recent developments exploring the philosophy of mathematics in education The unique combination of ethnomathematics philosophy history education statistics and mathematics offers a variety of different perspectives from which existing boundaries in mathematics education can be extended The ten chapters in this book offer a balance between philosophy of and philosophy in mathematics education Attention is paid to the implementation of a philosophy of mathematics within the mathematics curriculum **Philosophy Mathematics Educ** Paul Ernest, 2016-07-15 First Published in 1991 Routledge is an imprint of Taylor Francis an informa company Mathematics, Education and Philosophy ... , 1994 **Critical Philosophy of Mathematics** Ole Skovsmose, 2024-09-25 This book provides a philosophy of mathematics that resonates with critical mathematics education It draws attention to the social complexities that characterise the period of Modernity including the extreme exploitation of manual workers and their families brutal forms of colonisations trading of slaves and the formation of racist ideologies It portrays Modernity as a period of contradictions and highlights that mathematics is a part of these contradictions The text interprets mathematics as being indefinite seeing that mathematics is a part of the ongoing human constructions It outlines a performative interpretation of mathematics portraying mathematics as intrinsically connected to actions Any kind of action including mathematics based actions calls for ethical considerations and this leads to any mathematical practice either in research application or education to face ethical challenges It illustrates with examples how a critical philosophy of mathematics can come to be an integral part of classroom practices **Constructing Mathematical Knowledge** Paul Ernest, 2012-10-12 First published in 1994 This book and its companion volume Mathematics Education and Philosophy An International Perspective are edited collections Instead of the sharply focused concerns of the research monograph the books offer a panorama of complementary and forward looking perspectives They illustrate the breadth of theoretical and philosophical perspectives that can fruitfully be brought to bear on the mathematics and education The empathise of this book is on epistemological issues encompassing multiple perspectives on the learning of mathematics as well as broader

philosophical reflections on the genesis of knowledge It explores constructivist and social theories of learning and discusses the role of the computer in light of these theories

Explanation and Proof in Mathematics Gila Hanna, Hans Niels Jahnke, Helmut Pulte, 2009-12-04 In the four decades since Imre Lakatos declared mathematics a quasi empirical science increasing attention has been paid to the process of proof and argumentation in the field a development paralleled by the rise of computer technology and the mounting interest in the logical underpinnings of mathematics *Explanation and Proof in Mathematics* assembles perspectives from mathematics education and from the philosophy and history of mathematics to strengthen mutual awareness and share recent findings and advances in their interrelated fields With examples ranging from the geometers of the 17th century and ancient Chinese algorithms to cognitive psychology and current educational practice contributors explore the role of refutation in generating proofs the varied links between experiment and deduction the use of diagrammatic thinking in addition to pure logic and the uses of proof in mathematics education including a critique of authoritative versus authoritarian teaching styles A sampling of the coverage The conjoint origins of proof and theoretical physics in ancient Greece Proof as bearers of mathematical knowledge Bridging knowing and proving in mathematical reasoning The role of mathematics in long term cognitive development of reasoning Proof as experiment in the work of Wittgenstein Relationships between mathematical proof problem solving and explanation *Explanation and Proof in Mathematics* is certain to attract a wide range of readers including mathematicians mathematics education professionals researchers students and philosophers and historians of mathematics

Ethics and Mathematics Education Paul Ernest, 2024-06-10 This edited volume is an inquiry into the ethics of mathematics education and to a lesser extent the ethics of mathematics The imposition of mathematics for all raises questions of ethics What are the ethics of teaching school mathematics What are the costs as well as the benefits What are the ethical issues raised by the official aims of mathematics teaching the planned curriculum the pedagogies employed in school and college mathematics and the assessment systems These questions are addressed in the book as well as what systems of ethics we might use The volume ventures into a burgeoning new field It offers a unique set of investigations both theoretical and in terms of practices It announces the ethics of mathematics education as a new subfield of research and includes valuable contributions from many of the best known researchers in mathematics education additionally it is a valuable resource for students teachers and researchers in the field This is an enduring and classic source book in the field From the wisdom of leading scholars to the little heard voices of students this collection offers the reader many striking new insights into the ethics of mathematics and education

Reshaping School Mathematics National Research Council, Mathematical Sciences Education Board, 1990-02-01 The United States must restructure mathematics education both what is learned and the way it is taught if children are to develop the mathematical knowledge and skills they will need to be personally and professionally competent in the twenty first century Joining the recent reports that have opened a national dialogue on these issues *Reshaping School Mathematics*

focuses discussion on essential ideas that transcend details of current curricula or assessment results It examines changing perspectives on the role of mathematics in society and changing practice in the use of technology particularly calculators and computers in mathematics education

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