



Mathematics teaching, learning, and assessment in the digital age

Hans-Georg Weigand¹ · Jana Trgalova² · Michal Tabach³

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Abstract

The role of teaching, learning, and assessment with digital technology has become increasingly prominent in mathematics education. This survey paper provides an overview of how technology has been transforming teaching, learning, and assessment in mathematics education in the digital age and suggests how the field will evolve in the coming years. Based on several decades of research and educational practices, we discuss and anticipate the multifaceted impact of technology on mathematics education, thus laying the groundwork for the other papers in this issue. After a brief introduction discussing the motivations for this issue, we focus our attention on three lines of research: teaching mathematics with technology, learning mathematics with technology, and assessment with technology. We point to new research orientations that address the issue of teaching with technology, specifically describing attempts to conceptualise teachers' mathematical and digital competencies, perspectives that view teachers as designers of digital resources, and the design and evaluation of long-term initiatives to support teachers as they develop innovative teaching practices enhanced by digital technologies. Our examination shows that learning with technology is still marked by new conceptualizations raised by researchers that can further our understanding of this complex issue. These conceptualizations support the recognition that multiple resources, ranging from paper and pencil to augmented reality, participate in the learning process. Finally, assessment with technology, especially in the formative sense, offers new possibilities for offering individualised support for learners that can benefit from adaptive systems, though more tasks for conceptual understanding need to be developed.

Keywords Teaching with technology · Learning with technology · Assessment with technology · Mathematics education

1 Introduction

The widespread availability of digital educational technologies and resources will increasingly influence mathematics teaching and learning in the coming years. How will this growing influence affect teachers and students of mathematics? Which digital and analogue resources will be used in the classroom? How will the use of digital technology affect the theory of mathematics education and the implementation of ideas in the classroom? And finally, what are the consequences for ongoing and final classroom assessments? These questions have been discussed extensively

over the last decades in diverse mathematics education journals (see especially ZDM issues 55(1), 2023; 52(7), 2020; 52(5), 2020; 49(5), 2017; 44(6), 2012; 42(7), 2010; 41(4), 2009; 34(3), 2002) and at many conferences, especially the biennial *Congress of the European Society for Research in Mathematics Education* (CERME), which began in 1999. In 2018, a group of participants who were deeply involved in the CERME Thematic Working Groups on Technology took the initiative to launch the ERME Topic Conference for *Mathematics Education in the Digital Age* (MEDA). This conference sought to expand discussion of theoretical and practical knowledge and experience in the context of digital technologies and to look ahead at how mathematics education ought to be shaped in the coming years. The articles in this issue are significantly influenced by the three MEDA conferences and in particular are based on papers given at the 2022 MEDA3 conference held in Nitra, Slovakia (Weigand et al., 2022).

We begin by explaining the terminology we use in this article, followed by our methodological considerations. The

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What We Know about Mathematics Teaching and Learning ,2010 This book will provide affirmation to teachers and administrators who already use reform based approaches and encouragement to those who ve hesitated in adopting the approach in their classrooms or schools Carrie S Cutler lecturer early childhood education and elementary math University of Houston

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Making Math Accessible to Students With Special Needs (Grades 9-12) r4Educated Solutions,2011-12-30 The purpose of Making Math Accessible to Students With Special Needs is to support everyone involved in mathematics education to become confident and competent with mathematics instruction and assessment so that 99% of students will be able to access enrolled grade level mathematics Six chapters address topics critical to effective mathematical instruction such as federal and state legislation research based instructional best practices in mathematics and the selection administration and evaluation of accommodations for instruction and assessment These topics are combined to offer teachers understandable practical instructional procedures The resource guides readers through the 5E instructional model which provides an array of choices and strategies for providing high quality instruction to all students This resource actively engages readers through reflections and tasks in each chapter and can be used as a self study professional development or as a group book study Sample answers to tasks and reflections are found in the appendix along with additional supports

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Completed Diagram for Classifying Quadrilaterals *Research in Education* ,1972 Project-Based Learning in the Math Classroom Chris Fancher,Telannia Norfar,2021-10-03 Project Based Learning in the Math Classroom explains how to keep inquiry at the heart of mathematics teaching and helps teachers build students abilities to be true mathematicians This book outlines basic teaching strategies such as questioning and exploration of concepts It also provides advanced strategies for teachers who are already implementing inquiry based methods Project Based Learning in the Math Classroom includes practical advice about strategies the authors have used in their own classrooms and each chapter features strategies that can be implemented immediately Teaching in a project based environment means using great teaching practices The authors impart strategies that assist teachers in planning standards based lessons encouraging wonder and curiosity providing a safe environment where failure occurs and giving students opportunities for revision and reflection Grades 6 10 *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

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1. Understanding the eBook What We Know About Mathematics Teaching And Learning Third Edition
 - The Rise of Digital Reading What We Know About Mathematics Teaching And Learning Third Edition
 - Advantages of eBooks Over Traditional Books
2. Identifying What We Know About Mathematics Teaching And Learning Third Edition
 - Exploring Different Genres
 - Considering Fiction vs. Non-Fiction
 - Determining Your Reading Goals
3. Choosing the Right eBook Platform
 - Popular eBook Platforms
 - Features to Look for in an What We Know About Mathematics Teaching And Learning Third Edition
 - User-Friendly Interface
4. Exploring eBook Recommendations from What We Know About Mathematics Teaching And Learning Third Edition
 - Personalized Recommendations

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- 5. Accessing What We Know About Mathematics Teaching And Learning Third Edition Free and Paid eBooks
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 - What We Know About Mathematics Teaching And Learning Third Edition Enhanced eBook Features
- 7. Enhancing Your Reading Experience
 - Adjustable Fonts and Text Sizes of What We Know About Mathematics Teaching And Learning Third Edition
 - Highlighting and Note-Taking What We Know About Mathematics Teaching And Learning Third Edition
 - Interactive Elements What We Know About Mathematics Teaching And Learning Third Edition
- 8. Staying Engaged with What We Know About Mathematics Teaching And Learning Third Edition
 - Joining Online Reading Communities
 - Participating in Virtual Book Clubs
 - Following Authors and Publishers What We Know About Mathematics Teaching And Learning Third Edition
- 9. Balancing eBooks and Physical Books What We Know About Mathematics Teaching And Learning Third Edition
 - Benefits of a Digital Library
 - Creating a Diverse Reading Collection What We Know About Mathematics Teaching And Learning Third Edition
- 10. Overcoming Reading Challenges
 - Dealing with Digital Eye Strain
 - Minimizing Distractions
 - Managing Screen Time
- 11. Cultivating a Reading Routine What We Know About Mathematics Teaching And Learning Third Edition
 - Setting Reading Goals What We Know About Mathematics Teaching And Learning Third Edition
 - Carving Out Dedicated Reading Time
- 12. Sourcing Reliable Information of What We Know About Mathematics Teaching And Learning Third Edition
 - Fact-Checking eBook Content of What We Know About Mathematics Teaching And Learning Third Edition

- Distinguishing Credible Sources
- 13. Promoting Lifelong Learning
 - Utilizing eBooks for Skill Development
 - Exploring Educational eBooks
- 14. Embracing eBook Trends
 - Integration of Multimedia Elements
 - Interactive and Gamified eBooks

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