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Stylianou, Despina A. (ed.); Blanton, Maria L. (ed.); Knuth, Eric J. (ed.)

Teaching and learning proof across the grades. A K-16 perspective.

Studies in Mathematical Thinking and Learning Series. London: Routledge; Reston, VA: National Council of Teachers of Mathematics (NCTM); New York, NY: Taylor & Francis (ISBN 978-0-415-98984-8/hbk; 978-0-415-88731-1/pbk; 978-0-203-88200-9/ebook). xx, 388 p. (2009).

Publisher's description: In recent years there has been increased interest in the nature and role of proof in mathematics education; with many mathematics educators advocating that proof should be a central part of the mathematics education of students at all grade levels. This collection provides that much-needed forum for mathematics educators to articulate a connected K-16 "story" of proof. Such a story includes understanding how the forms of proof, including the nature of argumentation and justification as well as what counts as proof, evolve chronologically and cognitively and how curricula and instruction can support the development of students' understanding of proof. Collectively these essays inform educators and researchers at different grade levels about the teaching and learning of proof at each level and, thus, help advance the design of further empirical and theoretical work in this area. By building and extending on existing research and by allowing a variety of voices from the field to be heard, Teaching and Learning Proof Across the Grades not only highlights the main ideas that have recently emerged on proof research, but also defines an agenda for future study. Contents: Section I: Theoretical Considerations on the Teaching and Learning of Proof 1. What I Would Like My Students to Already Know About Proof (Reuben Hersh) 2. Exploring Relationships Between Disciplinary Knowledge and School Mathematics: Implications For Understanding the Place of Reasoning And Proof in School Mathematics (Daniel Chazan; H. Michael Lueke) 3. Proving and Knowing In Public: The Nature of Proof in A Classroom (Patricio Herbst; Nicolas Balacheff) Section II: Teaching and Learning of Proof in the Elementary Grades 4. Representation-based Proof in the Elementary Grades (Deborah Schifter) 5. Representations that Enable Children To Engage in Deductive Argument (Anne K. Morris) 6. Young Mathematicians At Work: The Role of Contexts And Models in the Emergence of Proof (Catherine Twomey Fosnot; Bill Jacob) 7. Children's Reasoning: Discovering the Idea of Mathematical Proof (Carolyn A. Maher) 8. Aspects of Teaching Proving In Upper Elementary School (David A. Reid; Vicki Zack) Section III: Teaching and Learning of Proof in Middle Grades and High School 9. Middle School Students' Production of Mathematical Justifications (Eric J. Knuth; Jeffrey M. Choppin; Kristen N. Bieda) 10. From Empirical to Structural Reasoning in Mathematics: Tracking Changes Over Time (Dietmar Küchemann; Celia Hoyles) 11. Developing Argumentation and Proof Competencies in the Mathematics Classroom (Aiso Heinze; Kristina Reiss) 12. Formal Proof in High School Geometry: Student Perceptions of Structure, Validity And Purpose (Sharon M; Soucy McCrone; Tami S. Martin) 13. When is an Argument Just An Argument? The Refinement of Mathematical Argumentation (Kay McClain) 14. Reasoning-and-Proving in School Mathematics: The Case of Pattern Identification (Gabriel J. Stylianides; Edward A. Silver) 15. "Doing Proofs" in Geometry Classrooms (Patricio Herbst; Chialing Chen; Michael Weiss; Gloriana Gonzalez; with Talli Nachlieli; Maria Hamlin; Catherine Brach) Section IV: Teaching and Learning of Proof in College 16. College Instructors' Views of Students Vis-a-Vis Proof (Guershon Harel; Larry Sowder) 17. Understanding Instructional Scaffolding in Classroom Discourse on Proof (Maria L. Blanton; Despina A. Stylianou; M. Manuela David) 18. Building a Community of Inquiry in a Problem-Based Undergraduate Number Theory Course: The Role of the Instructor (Jennifer Christian Smith; Stephanie Ryan Nichols; Sera Yoo; Kurt Oehler) 19. Proof in Advanced Mathematics Classes: Semantic and Syntactic Reasoning in the Representation System of Proof (Keith Weber; Lara Alcock) 20. Teaching Proving by Coordinating Aspects of Proofs with Students' Abilities (John Selden; Annie Selden) 21. Current Contributions toward Comprehensive Perspectives on the Learning and Teaching of Proof (Guershon Harel; Evan Fuller)

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