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# Developing Mathematical Thinking: Fractions

Greenwood, Jay

Note: This is not the actual book cover

# Developing Mathematical Thinking Fractions

**Jay Greenwood**



## **Developing Mathematical Thinking Fractions:**

Developing Mathematical Thinking Jay Greenwood, 1991-09-01      Developing Mathematical Thinking Jay Greenwood, 1986      Developing Mathematical Reasoning Pamela Weber Harris, 2025-02-13

Math is not rote memorizable  
Math is not random guessable  
Math is figure out able

Author Pam Harris argues that teaching real math that is free of distortions will reach more students more effectively and result in deeper understanding and longer retention. This book is about teaching undistorted math using the kinds of mental reasoning that mathematicians do. Memorization tricks and algorithms meant to make math easier are full of traps that sacrifice long term student growth for short lived gains. Students and teachers alike have been led to believe that they've learned more and more math but in reality their brains never get any stronger. Using these tricks may make facts easier to memorize in isolation but that very disconnect distorts the reality of math. The mountain of trivia piles up until students hit a breaking point. Humanity's most powerful system of understanding organizing and making an impact on the world becomes a soul draining exercise in confusion chaos and lost opportunities.

Developing Mathematical Reasoning: Avoiding the Trap of Algorithms emphasizes the importance of teaching students increasingly sophisticated mathematical reasoning and understanding underlying concepts rather than relying on a set rule for solving problems. This book illuminates a hierarchy of mathematical reasoning to help teachers guide students through various domains of math development from basic counting and adding to more complex proportional and functional reasoning. Everyone is capable of understanding and doing real math. This book highlights the important mathematical relationships strategies and models for students to develop. Offers personal stories reflection sections and extensive practical exercises for easy implementation. Includes real math a lot of it to provide teachers with examples they can put to use in their classrooms immediately. This book is a valuable resource for educators looking to reach more students by building a strong foundation of mathematical thinking in their students. By addressing common misconceptions about math and providing practical strategies for teaching real math this book shows that everyone can use the mathematical relationships they already know to reason about new relationships. In other words everyone can math.

**Unpacking Fractions** Monica Neagoy, 2017-03-10

For years the teaching and learning of fractions has been associated with rote memorization. But this mechanical approach to instruction which strips students of an ability to reason or make sense of math has resulted in a failure of understanding. Author Monica Neagoy drawing on decades of research studies evidence from teacher practice and 25 years of experience working around the world with teachers students and parents addresses seven big ideas in the teaching and learning of fractions in grades 2-6. Each idea is supported by a vignette from a real classroom common misconceptions a thorough unpacking of productive mathematical thinking and several multistep and thought provoking problems for teachers to explore. She offers three fundamental reasons why it's imperative for us to take a closer look at how we teach fractions.

- 1 Fractions play a key role in students feelings about mathematics
- 2 Fractions are fundamental to school

math and daily life 3 Fractions are foundational to success in algebra While a solid grounding in algebra is necessary for a STEM career the worthy goal of algebra for all will not be possible until fractions for all is a reality Unpacking Fractions provides teachers with concrete strategies for achieving that reality in short helping all students gain the knowledge they need to feel at ease with fractions

**A Focus on Fractions** Marjorie M. Petit, Robert E. Laird, Caroline B. Ebby, Edwin L. Marsden, 2015-07-24 A Focus on Fractions is a groundbreaking effort to make the mathematics education research on how students develop their understanding of fraction concepts readily accessible and understandable to pre and in service K 8 mathematics educators Using extensive annotated samples of student work as well as vignettes characteristic of classroom teachers experiences this book equips educators with the knowledge and tools to reveal students thinking so that they can modify their teaching and improve student learning of fraction concepts A Focus on Fractions 2nd edition includes sections on the Common Core State Standards for Mathematics and the Ongoing Assessment Project OGAP Fraction Framework integrated into each chapter as well as a new chapter on the OGAP Fraction Progression and how it can be used for formative assessment purposes This updated edition assists teachers in translating research findings into their classroom practice by conveying detailed information about how students develop fraction understandings Additional images and examples serve to flesh out and supplement the newly introduced concepts in this updated and expanded edition Special Features Looking Back Questions at the end of each chapter provide teachers the opportunity to analyze student thinking and consider instructional strategies for their own students Instructional Links help teachers relate concepts from the chapter to their own instructional materials and programs Big Ideas frame the chapters and provide a platform for meaningful exploration of the teaching of fractions Answer Key posted online offers extensive explanations of in chapter questions New sections devoted to the CCSSM and OGAP Fraction Progression are woven throughout the book as well as a new stand alone chapter on the OGAP Fraction Progression The OGAP Fraction Framework is an all new eResource now available as a free download from the book s website [www.routledge.com/9781138816442](http://www.routledge.com/9781138816442)

**Mathematical Thinking** Masami Isoda, Shigeo Katagiri, 2012 Developing mathematical thinking is one of major aims of mathematics education In mathematics education research there are a number of researches which describe what it is and how we can observe in experimental research However teachers have difficulties developing it in the classrooms This book is the result of lesson studies over the past 50 years It describes three perspectives of mathematical thinking Mathematical Attitude Minds set Mathematical Methods in General and Mathematical Ideas with Content and explains how to develop them in the classroom with illuminating examples

**On the Development of Mathematical Thought During the Nineteenth Century** John Theodore Merz, 1906

**Extending Children's Mathematics** Susan B. Empson, Linda Levi, 2011 With the collaboration of a number of dedicated teachers and their students Susan Empson and Linda Levi have produced a volume that is faithful to the basic principles of CGI while at the same time covering new ground with insight and innovation Thomas P Carpenter This

highly anticipated follow up volume to the landmark Children's Mathematics Cognitively Guided Instruction addresses the urgent need to help teachers understand and teach fraction concepts. Fractions remain one of the key stumbling blocks in math education and here Empson and Levi lay a foundation for understanding fractions and decimals in ways that build conceptual learning. They show how the same kinds of intuitive knowledge and sense making that provides the basis for children's learning of whole number arithmetic can be extended to fractions and decimals. Just as they did in Children's Mathematics and Thinking Mathematically, Empson and Levi provide important insights into children's thinking and alternative approaches to solving problems. Three themes appear throughout the book: building meaning for fractions and decimals through discussing and solving word problems; the progression of children's strategies for solving fraction word problems and equations from direct modeling through relational thinking; designing instruction that capitalizes on students' relational thinking strategies to integrate algebra into teaching and learning fractions. With illuminating examples of student work, classroom vignettes, Teacher Commentaries from the field, sample problems, and instructional guides provided in each chapter, you'll have all the tools you need to teach fractions and decimals with understanding and confidence.

**A Focus on Fractions** Marjorie M. Petit, Robert E. Laird, Caroline B. Eby, Edwin L. Marsden, 2022-07-29

The third edition of this book offers a unique approach to making mathematics education research on the teaching and learning of fraction concepts readily accessible and understandable to pre-service and in-service K-8 mathematics teachers. Revealing students' thought processes with extensive annotated samples of student work and vignettes characteristic of classroom teachers' experience, this book provides teachers a research-based lens to interpret evidence of student thinking, inform instruction, and ultimately improve student learning. Based on research gathered in the Ongoing Assessment Project (OGAP) and updated throughout, this engaging and easy-to-use resource also features two new chapters dedicated to understanding the OGAP Fraction Framework and Progression based on research conducted with hundreds of teachers to gather and interpret evidence of student learning along a learning progression referenced throughout the book so readers can apply the concepts to their instruction. A close focus on student work, including 180 annotated pieces of student work to help teachers improve their ability to recognize, assess, and monitor their students' errors and misconceptions, as well as their developing conceptual understanding. A discussion of decimal fractions, also new to the third edition. In chapter sections on how Common Core State Standards for Math (CCSSM) are supported by math education research. End-of-chapter Looking Back questions to allow teachers to analyze student thinking and consider instructional strategies for their own students. Instructional links to help teachers relate concepts from each chapter to their own instructional materials and programs. Accompanying online Support Material includes an answer key to Looking Back questions, as well as a copy of the OGAP Fraction Framework and Progression. A Focus on Fractions is part of the popular A Focus on collection designed to aid the professional development of pre-service and in-service mathematics teachers. As with the other volumes on addition and subtraction, ratios, and

proportions and multiplication and division this updated new edition bridges the gap between what math education researchers know and what teachers need to know in order to better understand evidence in student work and make effective instructional decisions

*The British National Film Catalogue*, 1983

*The Elementary Math Teacher's Book of Lists* Sonia M. Helton, Stephen J. Micklo, 1997 This is a unique information source and timesaver packed with 155 ready to use lists content and materials covering the entire K 6 math curriculum All of the lists patterns and worksheets are printed in a big spiral bound format ready to be photocopied as many times as needed and organized into 14 convenient sections including Standards and Methodologies Beginning Mathematics Geometry Numeration Counting Basic Operations Number Theory Fractions Decimals Measurement Probability Statistics Pre Algebra Problem Solving Technology and Ten Reproducible Patterns

**Developing Mathematical Practices in a Social Context** Debra A. Wheeldon, 2008 This teaching experiment used design based research DBR to document the norms and practices that were established with respect to fractions in a mathematics content course for prospective elementary teachers The teaching experiment resulted in an instructional theory for teaching fractions to prospective elementary teachers The focus was on the social perspective using an emergent framework which coordinates social and individual perspectives of development Social norms sociomathematical norms and classroom mathematical practices were considered A hypothetical learning trajectory HLT including learning goals instructional tasks tools and imagery and possible discourse was conjectured and implemented in the mathematics class Video tapes of the class sessions were analyzed for established norms and practices Resulting social norms were that students would a explain and justify solutions b listen to and try to make sense of other students thinking and c ask questions or ask for clarification when something is not understood Three sociomathematical norms were established These were expectations that students would a know what makes an explanation acceptable b know what counts as a different solution and c use meaningful solution strategies instead of known algorithms Two classroom mathematical practices with respect to fractions were established The first was partitioning and unitizing fractional amounts This included a modeling fractions with equal parts b defining the whole c using the relationship of the number of pieces and the size of the pieces and d describing the remainder in a division problem The second practice was quantifying fractions and using relationships among these quantities This included a naming and modeling fractions b modeling equivalent values and c using relationships to describe fractions Finally recommendations for revising the HLT for a future teaching experiment were made This will contribute toward the continuing development of an instructional theory for teaching fraction concepts and operations to prospective elementary teachers

*Impact of the Developing Mathematical Ideas Professional Development Program on Grade 4 Students' and Teachers' Understanding of Fractions. REL 2017-256* Madhavi Jayanthi, Russell Gersten, Mary Jo Taylor, Keith Smolkowski, Joseph Dimino, 2017 Contemporary state math standards emphasize that students must demonstrate an understanding of the mathematical ideas underlying the computations that have typically been the core

of the elementary school math curriculum. The standards have put an increased emphasis on the study of fractions in upper elementary grades which are the years during which students build a strong foundation in fractions concepts. At the same time, the National Mathematics Advisory Panel (2008) cites limited understanding of fractions as the key reason for the high failure rate in algebra courses. Longitudinal data from both the United States and the United Kingdom have demonstrated that knowledge of fractions in the elementary grades plays a powerful role in subsequent success in algebra, the gateway to math achievement in high school. Members of the Regional Educational Laboratory (REL) Southeast Improving Mathematics Instruction Research Alliance saw teachers' lack of in-depth knowledge of fractions concepts as a major challenge in their teaching these concepts to their students. Alliance members indicated that teachers would benefit from a professional development program that focused on building a deep understanding of the mathematical ideas underlying fractions and of how to apply those ideas in the classroom. This large-scale study investigates the effectiveness of such a program to help inform future district and state investments in professional development. Members of the REL Southeast Improving Mathematics Instruction Research Alliance formed a work group and selected Developing Mathematical Ideas (DMI) as the professional development program that seemed best suited to develop in-depth teacher knowledge of fractions and that could be scaled up in a large number of districts simultaneously. Developed by the Education Development Corporation, DMI is designed to help teachers think through major mathematical ideas and examine and reflect on how their students develop and understand the ideas. Teachers examine vignettes of classroom teaching and examples of student work from their own classes and from the classes of other participating teachers. Teachers also work on fractions problems designed to promote their own understanding of fractions concepts. The primary goal of the study was to assess the impact of DMI on grade 4 students and teachers' understanding of fractions. The study was conducted during the 2014-15 school year using data from 84 schools in eight school districts in three states: Florida, Georgia, and South Carolina. Participants included 4204 grade 4 students and 264 grade 4 teachers. Nine trained facilitators provided the professional development. The study used a randomized controlled trial, randomly assigning schools to either the treatment condition or the control condition. Teachers in schools in the treatment condition received 24 hours of DMI professional development on fractions during fall 2014. They attended eight three-hour sessions conducted over four days, two three-hour sessions per day, one day per month. In most cases, substitute teachers filled in for teachers during these days; in some cases, teachers preferred occasional Saturday sessions and were compensated for the additional workday. Teachers in the control condition did not receive DMI professional development but were free to participate in any type of school or district-provided professional development in math, including fractions. About a third of teachers in the control condition indicated that they had participated in some form of professional development in fractions. The student outcome measure was the Test for Understanding of Fractions, which was administered at the end of the school year to assess students' understanding of fractions concepts and their ability to

perform computations and word problems The teacher outcome measure was the Mathematical Knowledge for Teaching Fractions Scale Learning Mathematics for Teaching 2008 which was administered to all teachers at the end of the study to assess their understanding of the mathematical ideas involved in teaching fractions and their knowledge of the typical errors and misconceptions that can develop as students learn this material Key findings include 1 DMI did not demonstrate any impact on student proficiency in fractions Students of teachers who participated in DMI performed at almost the same level as students of teachers who did not participate the difference was not statistically significant  $p = 0.637$  and 2 The impact of DMI on teachers knowledge of fractions was inconclusive Teachers who participated in DMI performed 0.19 standard deviation better than teachers who did not participate but the difference was not statistically significant  $p = 0.051$  Thus DMI had nonsignificant impacts on students proficiency in fractions and their teachers knowledge of fractions The finding of no impact on students math proficiency is common in the research literature on professional development in math The results suggest that professional development that attempts to build teachers knowledge of the mathematical ideas underlying the K-8 curriculum though theoretically compelling does not always lead to improvements in student learning The following are appended 1 Study design and study sample 2 Reliability of measures 3 Online surveys and 4 Data analysis

**Harcourt Math**, 2003-03 **Developing Mathematical Thinking** Jay Greenwood, 1995-02 **Developing Mathematical Reasoning in Grades K-12** Lee Stiff, Frances R. Curcio, 1999 This book sharpens your view of mathematical reasoning and its development at all grade levels It reveals the various perspectives about the nature of reasoning Also it addresses the many issues and concerns involving mathematical reasoning how learners reason in mathematics how communication promotes reasoning how teachers gather evidence of student reasoning what curricular approaches can be profitably explored what can be done to ensure success in developing reasoning and more This useful resource lets you dig deep into the topic and offers many ideas useful in your classroom

*The Development of Mathematical Reasoning in Elementary School Students' Exploration of Fraction Ideas* Dina Yankelewitz, 2009 Reformers and educators across the U.S. and internationally have called for an increased emphasis on the learning and teaching of reasoning justification and proof in K-12 and post secondary mathematics education Numerous studies have established that students experience difficulty with these processes Recently however analysis of videotape data of sixth grade student work in an informal mathematics program has identified the use of multiple forms of reasoning by middle school students This qualitative study drawing on data from seventeen sessions from a longitudinal study conducted by Rutgers University in a fourth grade class of twenty five students in a suburban rural school in New Jersey identified and traced the development of the forms of reasoning and argumentation used by elementary school students as they were introduced to fraction as number concepts and as they used Cuisenaire rods and other manipulative materials to make sense of number relationships The following research questions guided this study 1 What forms of reasoning and argumentation are elicited as students work on tasks involving the building

of fraction ideas 2 How does students reasoning change as they revisit tasks introduced previously in the study and as they progress in their development of mathematical understandings Data for the study included forty six videotapes students collected written work and researcher field notes that were recorded during the seventeen 60 80 minute class sessions The methodology of Francisco Powell and Maher 2003 was used for video data analysis The video data was transcribed verified and coded for forms of reasoning and a storyline and narrative was constructed to describe the results Supplementary document analysis was used to verify and ensure validity of results Analysis of the data showed that students used varied forms of reasoning and argumentation Several tasks were flagged as supportive of the elicitation of varied forms of reasoning and factors of those tasks and of the environment that encouraged the development of reasoning in the students were explored The study has implications for effective strategies for the development of mathematical reasoning in the elementary school and ways that argumentation and proof can be introduced during the early school years Teaching Mathematics in Elementary and Middle School Joseph G. R. Martinez, Nancy Conrad Martinez, 2007 With an emphasis on inquiry and process Teaching Mathematics in Elementary and Middle School embraces active mathematics instruction and the development of mathematical thinking through problem solving The text challenges future teachers to prepare their K 8 students for a world that requires a higher level of mathematical literacy and enables them to compete in a global society Teachers will develop their own mathematical abilities allowing them to help students discover a rich combination of thinking processes and problem solving strategies raising the learning expectations for all Unique text features TIE Thought Investigation and Exploration features ask pre service teachers to develop their own thinking and learning abilities preparing them to better challenge their students Mathematics in the Real World Idea Files and Teacher Profiles model best practices and supply readers with concrete teaching tools and strategies Mathematical Thinking Mathematical Games and Mathematics and Technology features detail activities to engage and develop students mathematical thinking Accompanying student artifacts illustrate the progression of students conceptual understanding CD logo replaces bullet Math Activities CD ROM provides an outstanding text component containing more than 100 activities that use a three step process explore invent discover to foster the development of mathematical thinking through guided inquiry Aligned with the NCTM standards each activity is integrated within the text and designed to help develop students conceptual understanding of mathematics Mathematics in Literature offers thoroughly developed ideas for using children s literature to create meaningful contexts for mathematics learning An extensive bibliography that can be used for this purpose appears on the CD Rom I think the text is an excellent resource for elementary and middle school methods courses In particular I like how the textbook handles the bigger issues such as geometric reasoning rather than just geometry I also like the excellent foundation in educational research that the textbook provides as well as some very careful attention and consistent referencing to the NCTM standards and principles The incorporation of classroom vignettes teacher illustrations and samples of student work also all add to the excellent

grounding of the text in real world classroom work Dr Neal Grandgenett University of Nebraska at Omaha *Mathematics for Elementary Teachers* Albert B. Bennett, Leonard T. Nelson, 2004 This book is designed for courses in mathematics for instructors who choose to focus on and or take an activities approach This book provides inductive activities for prospective elementary school teachers and incorporates the use of physical models manipulatives and visual images to develop concepts and encourage higher level thinking This text contains activity sets one corresponding to each section of the companion text *Mathematics for Elementary Teachers A Conceptual Approach* also by Bennett Nelson The Activities Approach text can be used independently or along with its companion volume *The Development of Children's Fraction Thinking in a First-grade Classroom* Susan Carol Baker, 1994

## **Developing Mathematical Thinking Fractions** Book Review: Unveiling the Power of Words

In a world driven by information and connectivity, the energy of words has become more evident than ever. They have the ability to inspire, provoke, and ignite change. Such could be the essence of the book **Developing Mathematical Thinking Fractions**, a literary masterpiece that delves deep into the significance of words and their impact on our lives. Published by a renowned author, this captivating work takes readers on a transformative journey, unraveling the secrets and potential behind every word. In this review, we will explore the book's key themes, examine its writing style, and analyze its overall effect on readers.

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