

NCTM Resources for New and Early Career Teachers, Grades 6-8

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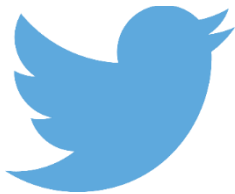


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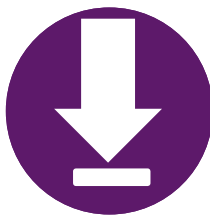


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NCTM Resources

- Illuminations
 - Mangoes Problem
- Publications
- Journals
 - Collaborative Planning as a Process
- Monthly Featured Resources
- ARCs
- The Math Forum
- Calculation Nation



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The Mangoes Problem

One night the King couldn't sleep, so he went down into the Royal kitchen, where he found a bowl full of mangoes. Being hungry, he took $\frac{1}{6}$ of the mangoes.

Later that same night, the Queen was hungry and couldn't sleep. She, too, found the mangoes and took $\frac{1}{5}$ of what the King had left.

Still later, the first Prince awoke, went to the kitchen, and ate $\frac{1}{4}$ of the remaining mangoes.

Even later, his brother, the second Prince, ate $\frac{1}{3}$ of what was then left.

Finally, the third Prince ate $\frac{1}{2}$ of what was left, leaving only three mangoes for the servants.

How many mangoes were originally in the bowl?

How Many of You Used the Following Method?

- Guess and Check
- Draw a Picture
- Work Backwards
- Write an Equation

Mangoes Problem

- Is this a high quality task? Why or why not?
- How would you use this problem with students?

Characteristics of a High Quality Task

A high-quality task has the following characteristics:

Aligns with relevant mathematics content standard(s)

Encourages the use of multiple representations

Provides opportunities for students to develop and demonstrate the mathematical practices

Involves students in an inquiry-oriented or exploratory approach

Allows entry to the mathematics at a low level (all students can begin the task) but also has a high ceiling (some students can extend the activity to higher-level activities)

Connects previous knowledge to new learning

Allows for multiple solution approaches and strategies

Engages students in explaining the meaning of the result

Includes a relevant and interesting context



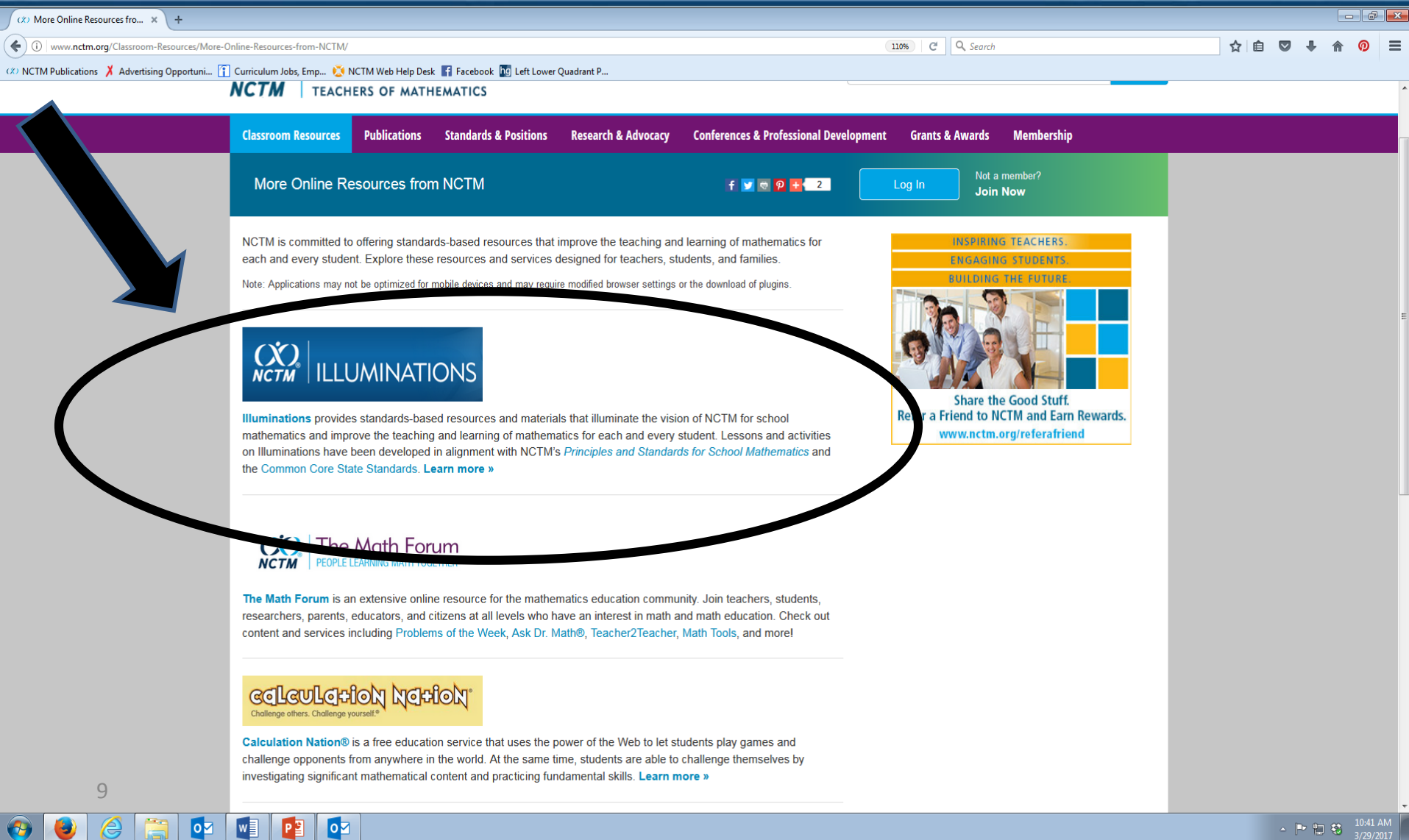
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Classroom Resources: Illuminations

The screenshot shows the NCTM website with the following elements:

- Browser Address Bar:** www.nctm.org
- Navigation Bar:** About, Affiliates, News & Calendar, Career Center, Get Involved, Support Us, NCTM Blog, The Math Forum, View Cart, NCTM Store
- Header:** NATIONAL COUNCIL OF TEACHERS OF MATHEMATICS
- Menu:** Classroom Resources (circled), Publications, Standards & Positions, Research & Advocacy, Conferences & Professional Development, Grants & Awards, Membership
- Classroom Resources Section:**
 - Aligning Content & Coherence - ARCs
 - Monthly Featured Resources
 - Reasoning & Sense Making Task Library
 - Illuminations & More Online Resources** (circled)
- Advertisements:**
 - Create mathematical images and handouts in minutes! A teacher favorite. [Get Started](#)
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- Journals Section:** Mathematics Teacher, Journal for Research in Mathematics Education, children's mathematics Visual
- Footer:** News, Calendar, Ken Krehbiel Named NCTM Executive Director, Apr NCTM 2017 Research Conference

Classroom Resources: Illuminations



The screenshot shows the NCTM Classroom Resources page. A large black arrow points from the top left towards the 'ILLUMINATIONS' section. A large black oval highlights the 'ILLUMINATIONS' section, which includes the NCTM logo, the word 'ILLUMINATIONS', and a paragraph describing the resources. Below this, there are sections for 'The Math Forum' and 'Calculation Nation'.

More Online Resources from NCTM

NCTM is committed to offering standards-based resources that improve the teaching and learning of mathematics for each and every student. Explore these resources and services designed for teachers, students, and families.

Note: Applications may not be optimized for mobile devices and may require modified browser settings or the download of plugins.

ILLUMINATIONS

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The Math Forum

The Math Forum is an extensive online resource for the mathematics education community. Join teachers, students, researchers, parents, educators, and citizens at all levels who have an interest in math and math education. Check out content and services including [Problems of the Week](#), [Ask Dr. Math®](#), [Teacher2Teacher](#), [Math Tools](#), and more!

calculation nation

Calculation Nation® is a free education service that uses the power of the Web to let students play games and challenge opponents from anywhere in the world. At the same time, students are able to challenge themselves by investigating significant mathematical content and practicing fundamental skills. [Learn more »](#)

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Classroom Resources: Illuminations

More Online Resources from... Illuminations

illuminations.nctm.org/Default.aspx

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NCTM | ILLUMINATIONS

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Lessons Interactives

Featured Lesson Plan

Featured Mobile Game

Featured Interactive

Featured Brain Teaser

Featured Mobile Game

We've released Equivalent Fractions back into the iTunes store—download it today!

1/2

read more

search site

Mangoes

☐ Lessons ☐ Interactives

NCTM Standards **Common Core Math Standards**

☐ Pre-K-2 ☐ 3-5

☐ 6-8 ☐ 9-12

☐ Number & Operations

☐ Algebra

☐ Geometry

☐ Measurement

☐ Data Analysis & Probability

SEARCH

Play Games
Challenge others.
Challenge yourself.

Brain Teasers
Test your skills.
Tease your brain.

Success Stories
Your Success Defines Our Success.

engage^{ny} math
is
EUREKA MATH™
FREE TEACHER RESOURCE PACK

3 gamers currently online

read more

read more

read more

Classroom Resources: Illuminations

search site

☐ Lessons ☐ Interactives

NCTM Standards	Common Core Math Standards
☐ Pre-K-2	☐ 3-5
☐ 6-8	☐ 9-12
☐ Number & Operations	
☐ Algebra	
☐ Geometry	
☐ Measurement	
☐ Data Analysis & Probability	

Mangoes Problem - Implementation

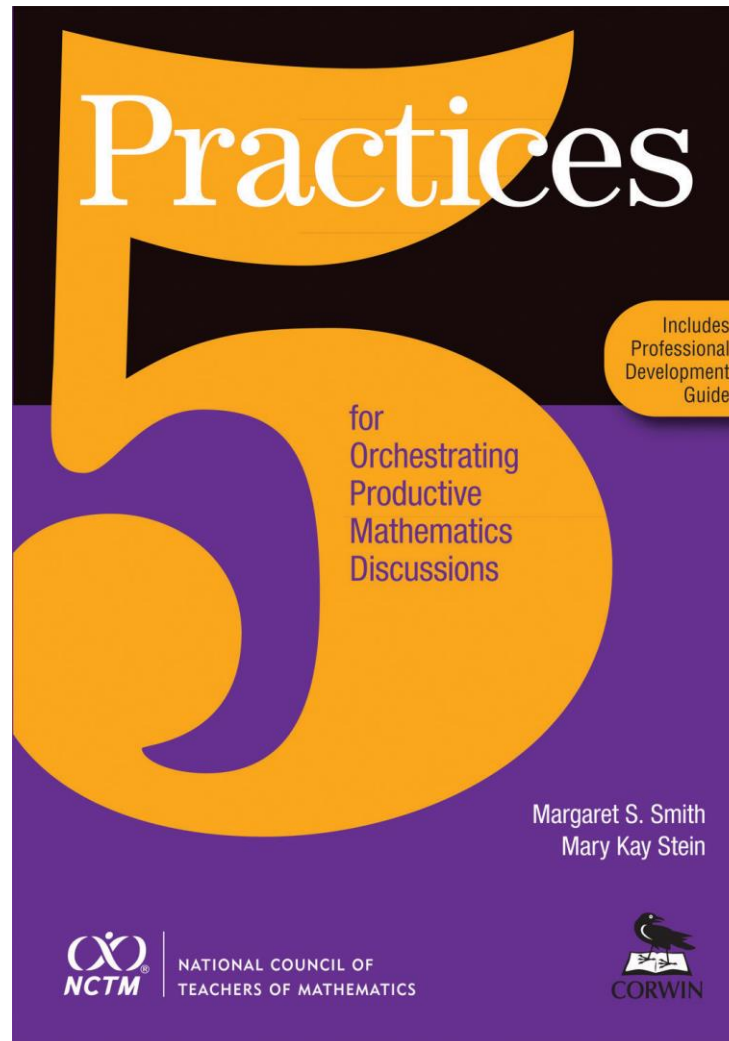
- What do you consider when implementing a high quality task?
- What did you notice about our implementation of the Mangoes Problem?

Five Practices

- **Anticipating**
 - Likely student responses to challenging mathematical tasks
- **Monitoring**
 - Students' actual responses to the tasks
- **Selecting**
 - Particular students to present their mathematical work during the whole-class discussion
- **Sequencing**
 - The student responses that will be displayed in a specific order
- **Connecting**
 - Different students' responses and connecting the responses to key mathematical ideas

5 Practices

for Orchestrating Productive Mathematics Discussion



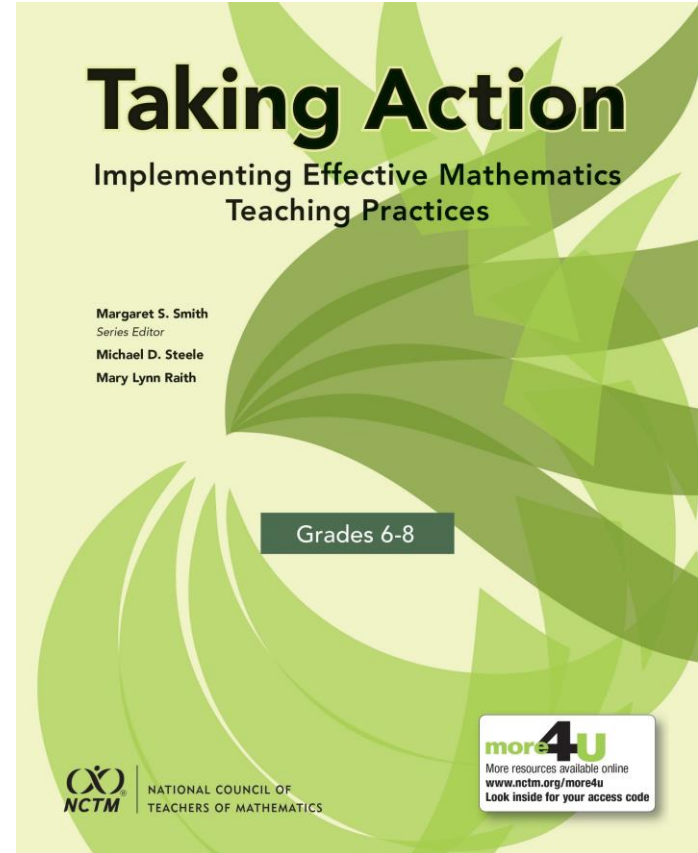
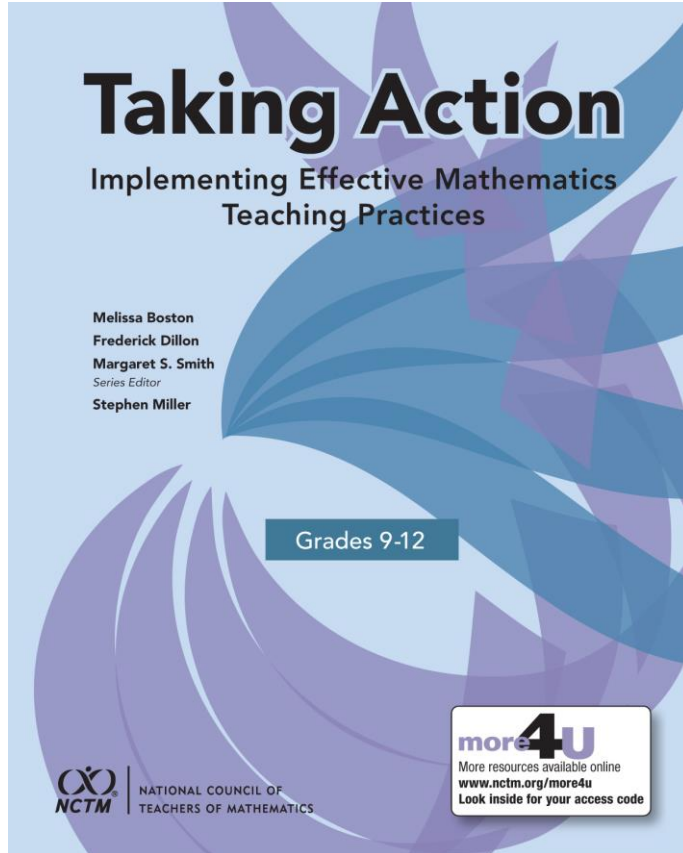
NCTM Publications:

Principles to Actions



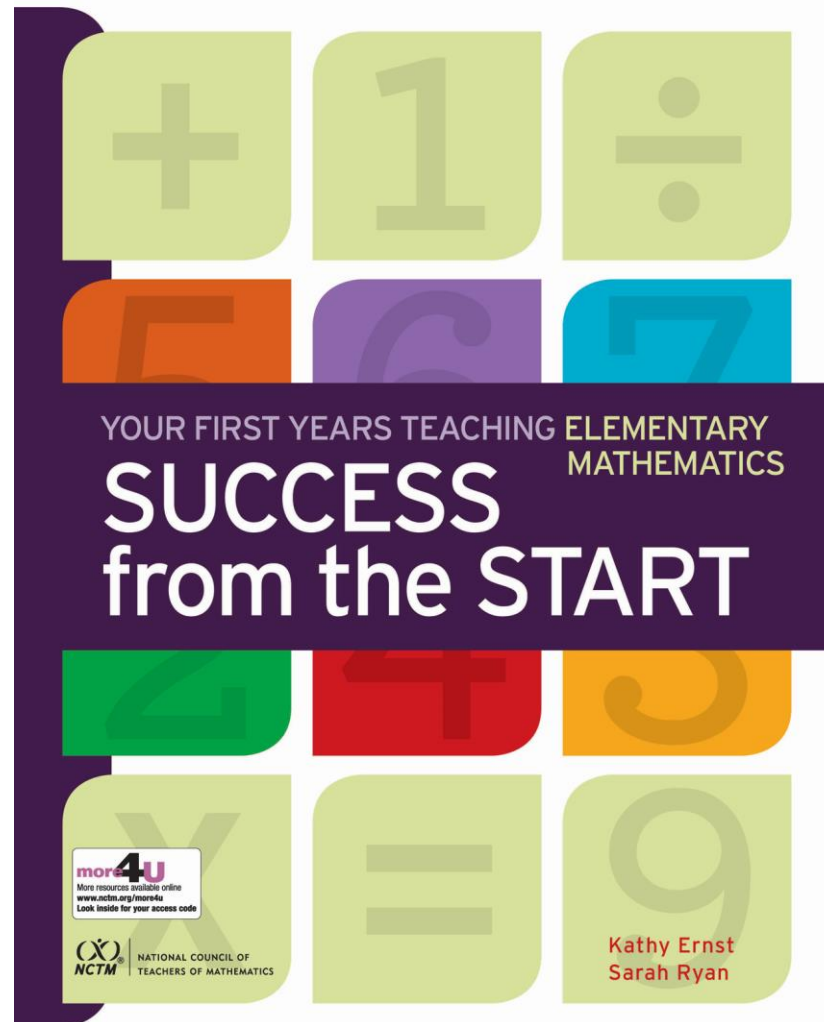
NCTM Publications:

Taking Action: Implementing Effective Mathematics Teaching Practices in Grades (K-5, 6-8, 9-12)



NCTM Publications:

Success From the Start: Your First Years Teaching Elementary/Secondary Mathematics



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NCTM Publications:

Developing Essential Understanding Series

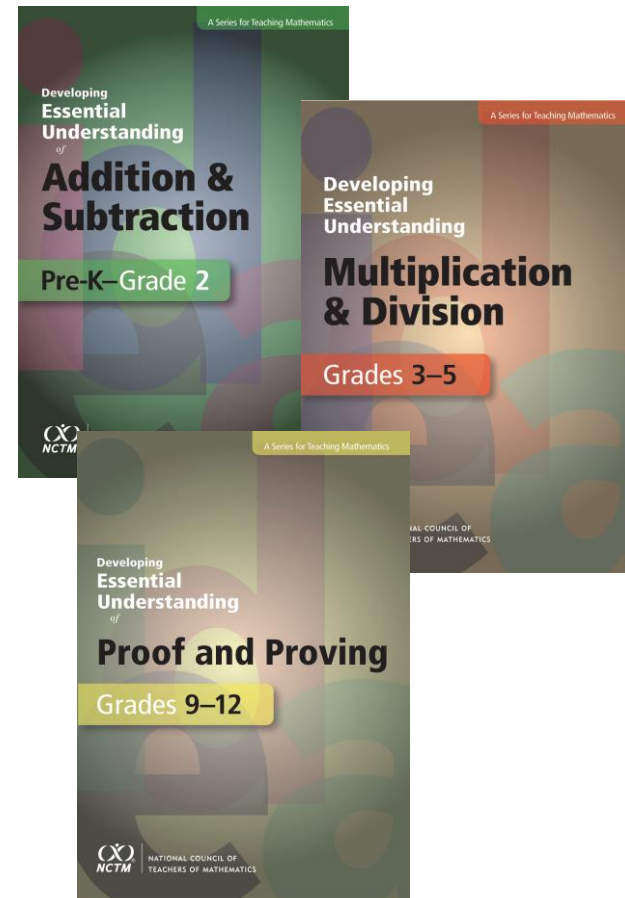
For pre-K–2: number and numeration; addition and subtraction; geometry and measurement

For grades 3–5: algebraic thinking; rational numbers; multiplication and division; geometry and measurement

For grades 6–8: ratios, proportions, and proportional reasoning; expressions, equations, and functions; geometry; statistics

For grades 9–12: functions; proof and proving; geometry; statistics

For pre-K–grade 8: mathematical reasoning



NCTM Publications:

Putting Essential Understanding into Practice Series

For pre-K–2: addition and subtraction; geometry and measurement

For grades 3–5: multiplication and division; geometry and measurement; fractions

For grades 6–8: ratios & proportions

For grades 9–12: functions; geometry; statistics



NCTM Publications

- Can be purchased at bookstore for 25% off
- <https://www.nctm.org/store/>
 - If member, 20% off
 - Plus shipping

NCTM Journals

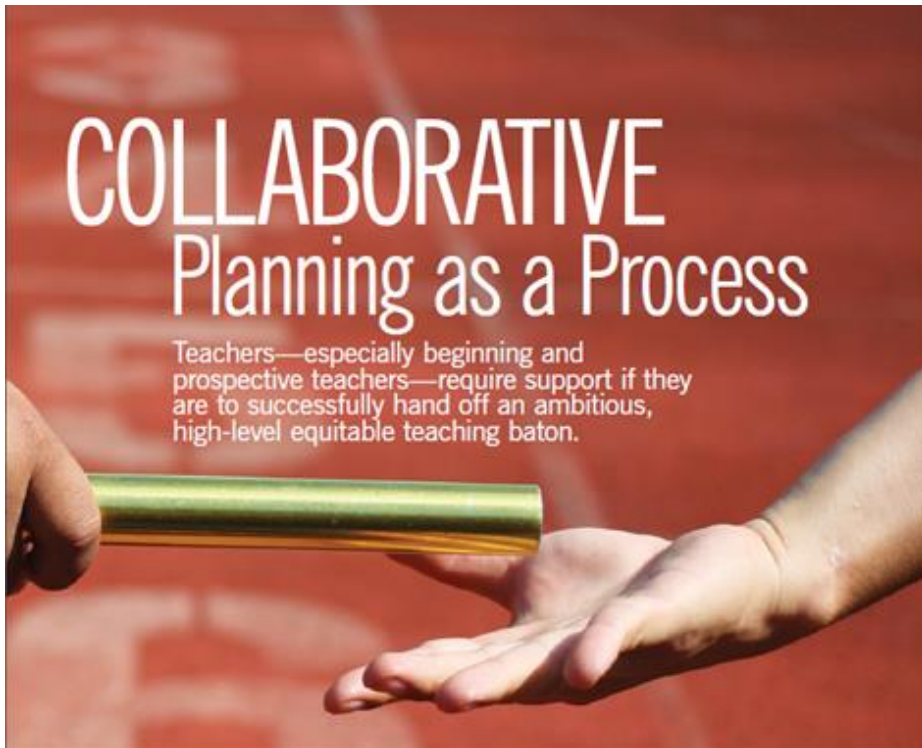


The focus of the journal is on intuitive, exploratory investigations that use informal reasoning to help students develop a strong conceptual basis that leads to greater mathematical abstraction.



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NCTM Journals MTMS



MTMS , Vol. 22, NO. 7, March 2017

To develop students' conceptual understanding, teachers must learn such skills as how to **select**, **plan**, and **enact cognitively demanding tasks** (CDT) (Lambert and Stylianou 2013; Smith, Bill, and Hughes 2008) and to evaluate evidence of student learning (Hiebert et al. 2007)



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Four-Part Process

1. Design or modify a cognitively demanding task
2. Develop the lesson plan using the Thinking Through a Lesson Protocol (TTLP) (Smith et al. 2008)
3. Enact the task so that all students are given an opportunity to participate (Lambert and Stylianou 2013)
4. Collect student work, analyze it, and reflect on evidence of learning

Collaborative Planning

- 1. Design or modify a cognitively demanding task**
2. Develop the lesson plan using the Thinking Through a Lesson Protocol (TTLP) (Smith et al. 2008)
3. Enact the task so that all students are given an opportunity to participate (Lambert and Stylianou 2013)
4. Collect student work, analyze it, and reflect on evidence of learning

Cognitively Demanding Task

- Lower-level demands
 - Memorization
 - Procedures without connections
- Higher-level demands
 - Procedures with connections
 - Doing mathematics

Levels of Demand

Lower-level demands (memorization):

- reproducing previously learned facts, rules, formulas, definitions or committing them to memory
- Cannot be solved with a procedure
- Have no connection to concepts or meaning that underlie the facts rules, formulas, or definitions

Lower-level demands (procedures without connections):

- are algorithmic
- require limited cognitive demand
- have no connection to the concepts or meaning that underlie the procedure
- focus on producing correct answers instead of understanding
- require no explanations

Higher-level demands (procedures with connections):

- use procedure for deeper understanding of concepts
- broad procedures connected to ideas instead narrow algorithms
- usually represented in different ways
- require some degree of cognitive effort; procedures may be used but not mindlessly

Higher-level demands (doing mathematics):

- require complex non-algorithmic thinking
- require students to explore and understand the mathematics
- demand self-monitoring of one's cognitive process
- require considerable cognitive effort and may involve some level of anxiety b/c solution path isn't clear



Design or Modify a Cognitively Demanding Task

- Look through activity sheet 1
 - What is the learning outcome
 - What is cognitive demand?
 - Are there modifications that you can make to maximize learning outcomes on this task?
 - Do it! (in groups)
- Share out
- What was your thought process as you were modifying the task?

Compare & Contrast

- Activity sheet 4
- How do the modifications that Kaiser made from activity sheet 1 to activity sheet 4 compare to your modifications?
- Do you agree with Kaiser's modifications?

Set of Principles to Govern Task Design

Fig. 1 A class developed this set of principles to govern task design.

1. Scaffolding
 - A. Take away/remove
 - Questions that promote recall
 - Fill-in-the-blank questions
 - B. Add
 - Accessibility
 - Connection to prior knowledge
 - Opportunities to brainstorm
2. Provide access through exploration to develop understanding.
3. The overall structure should balance promoting student struggle and helplessness.
4. Inductive-to-deductive reasoning
 - A. Reasoning and proving (Stylianides 2008)
 - Look for patterns
 - Make a generalization
 - Develop an argument (proof or nonproof)

Do you or
have you
worked in a
collaborative
group to plan?

Collaborative Planning

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- 3. Enact the task so that all students are given an opportunity to participate (Lambert and Stylianou 2013)**
- 4. Collect student work, analyze it, and reflect on evidence of learning**

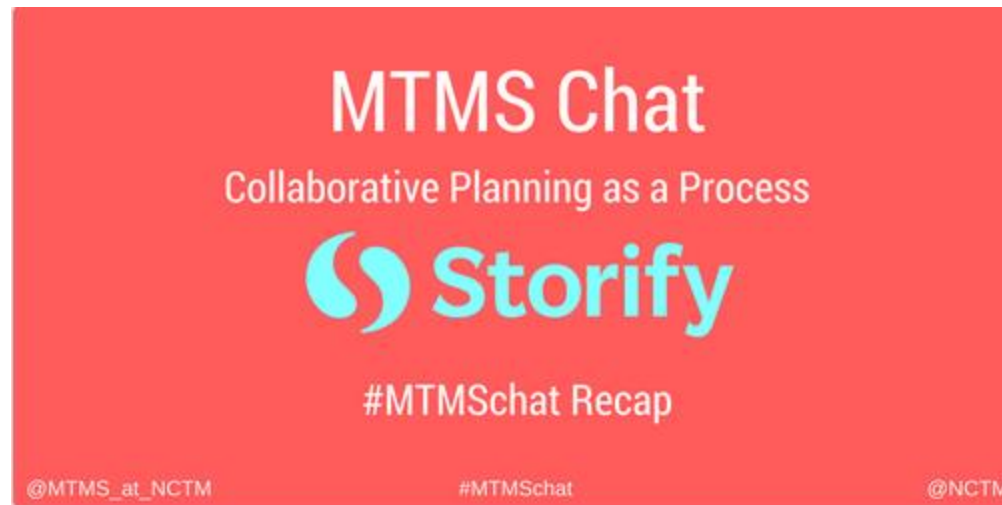
NCTM Journals: Submitting

Detailed information on writing for and being published in the journals

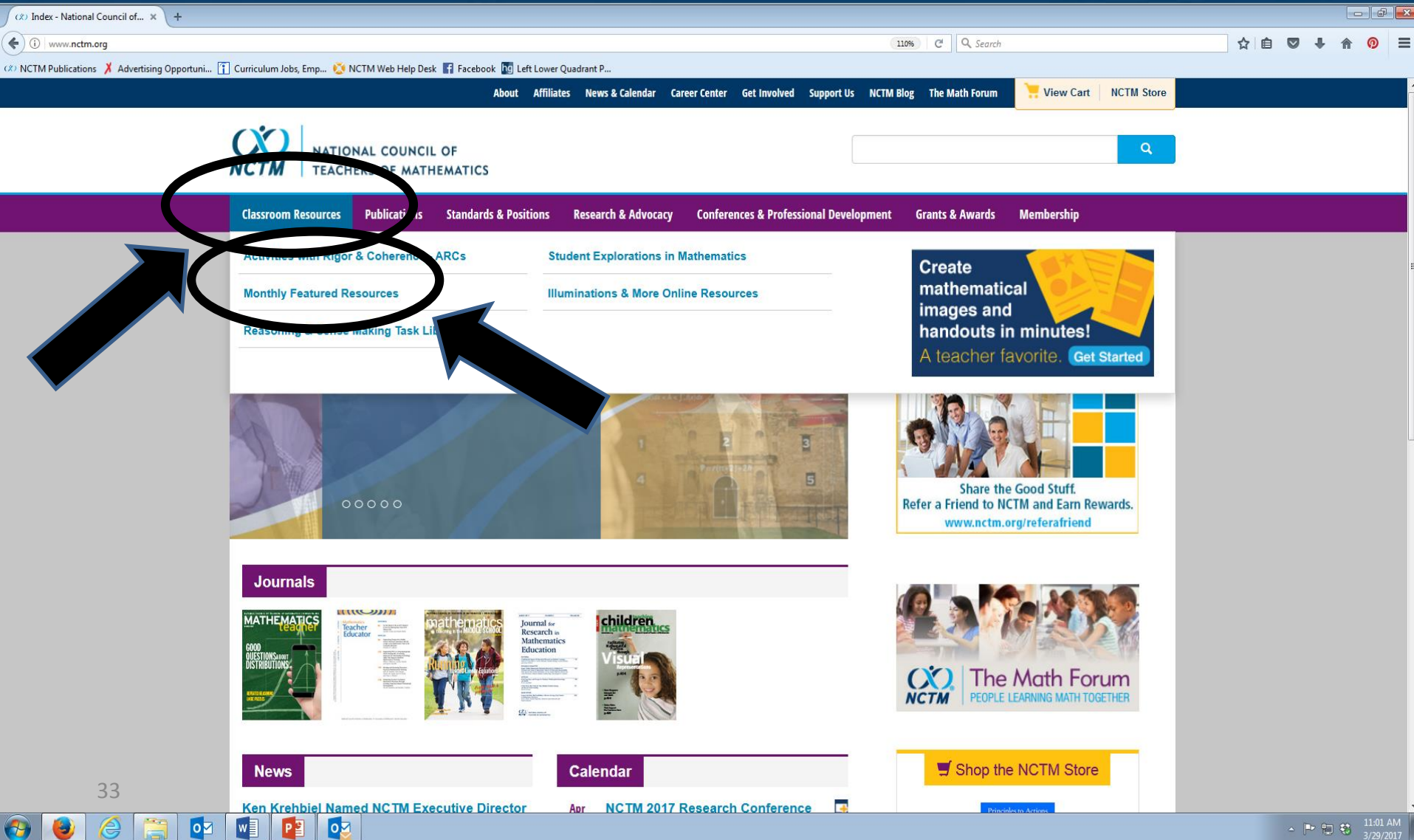
<http://www.nctm.org/Publications/Write,-Review,-Referee/>

NCTM Journals: Twitter Chat

- Monthly chats every 3rd Wednesday
- #MTMSchat



Classroom Resources: Monthly Featured Resources



The screenshot displays the NCTM (National Council of Teachers of Mathematics) website. The top navigation bar includes links for About, Affiliates, News & Calendar, Career Center, Get Involved, Support Us, NCTM Blog, The Math Forum, View Cart, and NCTM Store. The main navigation bar features links for Classroom Resources, Publications, Standards & Positions, Research & Advocacy, Conferences & Professional Development, Grants & Awards, and Membership. The 'Classroom Resources' link is highlighted with a black oval. Below this, the 'Monthly Featured Resources' link is also highlighted with a black oval and a black arrow. The main content area shows a list of resources, including 'Activities with Rigor & Coherence', 'Student Explorations in Mathematics', 'Monthly Featured Resources', 'Illuminations & More Online Resources', and 'Reasoning & Problem Solving Task List'. A large black arrow points to the 'Monthly Featured Resources' link. To the right, there is a promotional banner for 'Create mathematical images and handouts in minutes!' with a 'Get Started' button. Below this, there is a section for 'Share the Good Stuff' with a referral link. The bottom of the page features a 'Journals' section with various math-related journals, a 'News' section with a headline about Ken Krehbiel, and a 'Calendar' section with a headline about the NCTM 2017 Research Conference. A 'Shop the NCTM Store' button is also visible.

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Classroom Resources: Monthly Featured Resources

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discuss these and other NCTM classroom resources.

View Past Featured Resources

Primary

This month, we are celebrating Pi Day. Since pi is so closely related to measuring circles, primary students can celebrate Pi Day by exploring measurement. This month's featured resource is "A Mathematical Measurement Mystery" from Teaching Children Mathematics. Primary students investigate how to measure big things and small things around school, and then compare their measurements to measurements from a mystery school . . . where something big is happening! If you use this activity to celebrate Pi Day, challenge older students to measure not only length and height but also to measure all the way around such objects as round tables, playground equipment, and other circular items found in real life.

Get Article

Grades 3-5

What can elementary students discover about pi? "What is pi's role across the K-12 curriculum?" was asked of the [Math Forum at NCTM's Teacher-to-Teacher site](#). The [response from Gail Englert](#), an elementary school teacher and T2T Associate, gives elementary teachers a great starting point for having students explore pi through measuring circles of all sizes. Englert's story focuses on how she let students experience productive struggle as they made sense of how to measure a circle. She kept in mind that what seems obvious to adults is a brand-new idea for students, and that students need opportunities to have "aha!" moments about concepts like how to use tape measures to measure circular objects. As you read Englert's post, click "Next" and "Previous" to read other replies in the discussion. What does a jar of tennis balls have to do with pi?

For more Math Forum resources about pi, including its history, how it is calculated, whether it really is equal to $3 \frac{1}{7}$, and even how pi has been legislated, check out [Dr. Math's FAQ about pi](#).

Get Discussion

Grades 6-8

Middle school is the best time to celebrate pi because middle school students are learning about formulas for finding area and circumference, exploring ratio and proportion, and investigating irrational numbers. Pi is all of those! The [Apple Pi unit](#) from Illuminations is full of investigations and interactives that students can use to understand pi as a ratio; to understand how pi relates to the area of a circle as well as its circumference; and to understand what area, circumference, radius, and diameter each tell us about circles. (check out the

Algebra 1

Do your algebra 1 students know that pi, because it is a ratio, is also a slope? In the [Pi Line](#) investigation from Illuminations, students "unwrap" circles of

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The Math Forum:

Teacher2Teacher (T2T)

Do you have a question about teaching mathematics? [Ask a Question](#) to receive a response from one of our [T2T Associates](#). Visit the [Teachers' Lounge](#) where you can participate in current math education discussions.

Ask Dr. Math

Do you have a math question? [Browse](#) or [search](#) the archive.

Calendar

Apr 3

NCTM 2017 Research Conference
San Antonio, Texas



Apr 5

NCTM 2017 Annual Meeting and Exposition
San Antonio, Texas



Apr 27

Minnesota Council of Teachers of Mathematics: Ross Taylor Symposium





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Classroom Resources: ARCs

The screenshot shows the NCTM website with the 'Classroom Resources' menu item circled in black. A large black arrow points from the left towards this menu item. Another black arrow points from the 'Activities with Rigor & Coherence - ARCs' link to a 'Journals' section below. The 'Journals' section displays four journal covers: 'MATHEMATICS teacher', 'mathematics for the teacher educator', 'mathematics for research in mathematics education', and 'children's mathematics'. The 'News' section at the bottom mentions 'Ken Krehbiel Named NCTM Executive Director' and 'NCTM 2017 Research Conference'. The 'Calendar' section is also visible. The 'The Math Forum' logo is present in the bottom right corner.

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High School Reasoning and Sense
Making Task Library

Illustrations & More Online
Resources

Monthly Featured Resources

Math Forum Problems of the Week
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Classroom Resources: Calculation Nation

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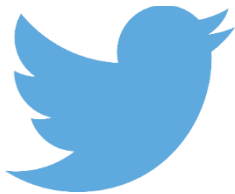
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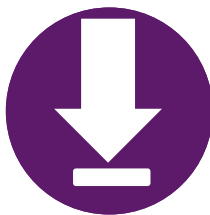


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