



Building Computational Fluency with Focused Practice Sets

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July 16, 2018



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About the Dana Center

— Equity — Access — Excellence —

Dana Center by the Numbers



Dana Center by the Numbers

By the close of 2017, the Dana Center had contributed to the **implementation of math pathways** in higher education systems, institutions, and campuses in **29 states**.



Dana Center by the Numbers



We engaged with **118 districts in 23 states** to provide middle and high school math courses of the **highest quality**, as recognized by rigorous national and state reviews, including EdReports.org, Louisiana Department of Education, and Texas Education Agency panels.

Agenda

- **Gain a common understanding of what it means for students to be computationally fluent.**
- **Why fluency matters**
- **Discuss and clarify the TEKS that support fluency in middle school.**
- **Look at examples of how to support fluency in the classroom.**
- **Practice and apply.**

Resources

<https://padlet.com/lisabrown/fluency18>



What is fluency?

What the National Council of Teachers of Mathematics (NCTM) says...

- Fluency is more than just being fast and accurate.
- Being fluent means students can apply procedures accurately, efficiently, and flexibly.
- Procedural fluency builds on conceptual understanding.
- Practice should be brief, engaging, purposeful, and distributed.

NCTM. (2014). *Principles to Actions: Ensuring Mathematical Success for All*.
Reston, VA: National Council of Teachers of Mathematics, pages 42-48.

NCTM. (2014). *Procedural Fluency in Mathematics: A Position of the National Council of Teachers of Mathematics*.
Reston, VA: National Council of Teachers of Mathematics.

What are the fluency standards?

6th grade

- **6.3.D:** add, subtract, multiply, and divide integers fluently
- **6.3.E:** multiply and divide positive rational numbers fluently

7th grade

- **7.3.A:** add, subtract, multiply, and divide rational numbers fluently

What about fluency in 8th grade?

8th grade

- **There are no specific fluency standards.**
- **Applying fluency**
 - **8.8.C:** model and solve one-variable equations with variables on both sides of the equal sign that represent mathematical and real-world problems using rational number coefficients and constants

What are your current approaches?

- **What are you currently doing to promote fluency?**
- **What practices are effective?**
- **What practices are not effective (yet)?**

A quote...

- **“...giving students too many practice problems too soon is an ineffective approach to fluency. Students need to practice on a moderate number of carefully selected problems...‘spacing’ or distributing these over time, and including feedback on student performance supports learning outcomes.”**

NCTM. (2014). *Principles to Actions: Ensuring Mathematical Success for All*. Reston, VA: National Council of Teachers of Mathematics, page 45.

NCTM *Principles to Actions* (2014)



Principles to Actions: Mathematics Teaching Practices

- 1. Establish mathematics goals to focus learning.**
- 2. Implement tasks that promote reasoning and problem solving.**
- 3. Use and connect mathematical representations.**
- 4. Facilitate meaningful mathematical discourse.**
- 5. Pose purposeful questions.**
- 6. Build procedural fluency from conceptual understanding.**
- 7. Support productive struggle in learning mathematics.**
- 8. Elicit and use evidence of student thinking.**

NCTM. (2014). *Principles to Actions: Ensuring Mathematical Success for All*. Reston, VA: National Council of Teachers of Mathematics, page 10.

Principles to Actions

- “When procedures are connected with the underlying concepts, students have better retention of the procedures and are more able to apply them in new situations...”**
- “A rush to fluency undermines students’ confidence and interest in mathematics and is considered a cause of mathematics anxiety.”**

NCTM. (2014). *Principles to Actions: Ensuring Mathematical Success for All*. Reston, VA: National Council of Teachers of Mathematics, page 42.

Building procedural fluency from conceptual understanding

What are teachers doing?	What are students doing?
<ul style="list-style-type: none"> • Providing students with opportunities to use their own reasoning strategies and methods for solving problems • Asking students to discuss and explain why the procedures that they are using work to solve particular problems. • Connecting student-generated strategies and methods to more efficient procedures as appropriate. • Using visual models to support students' understanding of general methods. • Providing students with opportunities for distributed practice of procedures. 	<ul style="list-style-type: none"> • Making sure that they understand and can explain the mathematical basis for the procedures that they are using. • Demonstrating flexible use of strategies and methods while reflecting on which procedures seem to work best for specific types of problems. • Determining whether specific approaches generalize to a broad class of problems. • Striving to use procedures appropriately and efficiently.

NCTM. (2014). *Principles to Actions: Ensuring Mathematical Success for All*. Reston, VA: National Council of Teachers of Mathematics, pages 47-48.

Building fluency

What research says

Fluency with understanding

- Number talks
- Worked examples

Practice

- Small sets
- Distributed practice
 - Just in time review
 - Reinforcement
- Student created problems

See references list

www.padlet.com/lisabronwn/fluency

Practice

Brief, carefully selected sets

4. **REINFORCE** Find the product and record your answer in simplest form.

a. $\frac{4}{5} \cdot \frac{1}{3} =$

b. $\frac{3}{10} \cdot \frac{1}{2} =$

c. $\frac{2}{3} \cdot \frac{3}{10} =$

d. $\frac{1}{4} \cdot \frac{3}{9} =$

e. $\frac{6}{7} \cdot \frac{7}{6} =$

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Practice – student created examples

8. **REINFORCE** For each situation below, write a number sentence and show the resulting product.

a. The product of $\frac{3}{4}$ and a number so that the product is greater than $\frac{3}{4}$.

b. The product of 3 and a number so that that product is less than 1.

c. The product of $\frac{5}{8}$ and a number so that the product is a whole number greater than 5.

d. The product of $\frac{1}{4}$ and a number so that the product is less than $\frac{1}{4}$.

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Practice - distributed

8. **REINFORCE** Solve to find the value of n that makes each statement true.

a. $\frac{4}{5}n = 10$

b. $n - 3.25 = 8.5$

c. $\frac{n}{8} = 2\frac{1}{2}$

d. $4.5n = 33.75$

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Let's practice our practice

- **Select a practice set – use one of our samples, or navigate elsewhere to find one.**
- **Identify 3-5 items to keep, and be able to explain why you kept them.**
- **Generate 2 or 3 prompts for student-generated examples.**
- **Add 2 or 3 more items covering previously practiced fluency standards.**

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