

# STRONG RESEARCH EVIDENCE SUPPORTS MATH FORCE



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Math Force is a complete mathematics program for grades 3–8. It is a highly engaging interactive resource for individuals and full classrooms. Although the main driver of engagement is the online experience, learning also takes place via print and other media.

By “complete” we mean that the content and methodologies are suited for all schools and students. It allows teachers to make a variety of choices about what to teach and offers many special ways to encourage learning. The overall philosophy of Math Force is to increase the interest and appetite for learning and to move forward in mathematics. With that philosophy and attitude, this program will be able to raise the achievement levels of all students. [1]

Math Force is built on several key research-based practices to ensure that solid learning takes place. These key practices range from the organization of content to its presentation through digital models. Beyond these global qualities, this paper highlights four specific teaching methods utilized throughout the program — what they are and the strong research evidence supporting them.

## Gradual Release

The gradual release approach to teaching and training has been used in many fields. Modeled on coaching in sports and in the arts (e.g., dance), this method is now used with great validity in the classroom — from classic frontal teaching to digital instruction. Research in math education over the past 20 years has shown positive outcomes in the mathematics classrooms, even those with a wide variance of students.

This methodology is usually set out in steps. The overall goal is to shift the responsibility from the teacher to the student. These are the steps most frequently used:

- Teacher introduces a new concept or skill,
- Teacher then guides students to understanding,
- Students discuss among themselves, and
- Students demonstrate mastery on their own.

In short, “I Do, We Do, You Do with other students or on your own.”

### I DO – Teacher Led Instruction

EXAMPLE	
Compare $\frac{2}{3}$ and $\frac{5}{12}$ .	
SOLUTION	
	<p>12 is a multiple of both 3 and 12. I changed <math>\frac{2}{3}</math> into twelfths by multiplying the numerator and denominator by 4.</p>
$\frac{2 \times 4}{3 \times 4} = \frac{8}{12}$ <p><math>\frac{8}{12}</math> is greater than <math>\frac{5}{12}</math>.</p> <p>So <math>\frac{2}{3}</math> is greater than <math>\frac{5}{12}</math>.</p>	

**TRY IT** Which of these fractions is greatest?  
 $\frac{5}{6}$ ,  $\frac{7}{12}$ ,  $\frac{11}{12}$

**COMPARE** Compare the size of various fractions.  
**CHECK** Check your answers.

### WE DO – Students and Virtual Tutor

**YOU DO – Student work in groups or alone and check their work**

## Scaffolding

When a teacher or tutor assists students by asking questions or providing hints that is scaffolding — as in support. The teacher or tutor guides the student by offering prompts, cues, or paths to better understand a concept, solve a problem, interpret a result, or when and how to apply a skill.

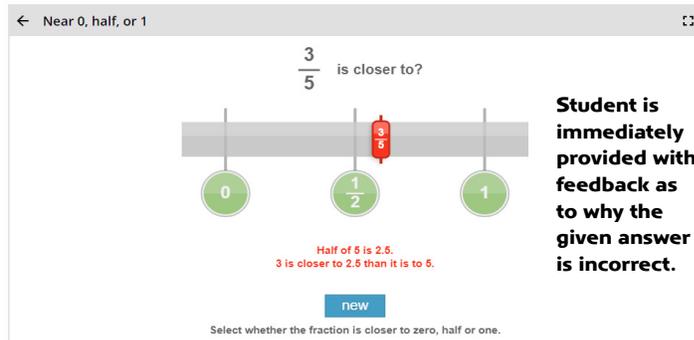
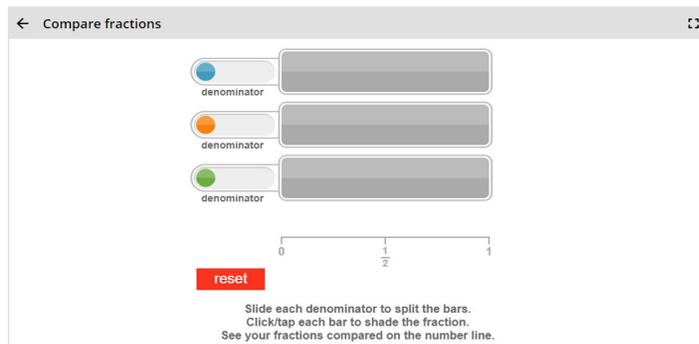
Scaffolding is an important part of the teaching machinery in Math Force. Research has validated its usefulness for all ability levels and at all grades. [3, 4, 5] Instruction via Math Force comes in the form of lessons and tasks accompanied by an array of support material that asks questions, offers hints, suggests games, and adapts to support students towards mastery.

## Effective use of Virtual Manipulatives

Evidence supports the effectiveness of curricular materials that use virtual manipulatives and are designed to promote conceptual understanding in addition to procedural fluency. Technology can efficiently scale best practices and support teachers in helping students make sense of fractions. Fraction concepts are inherently difficult; and lack of mastery often holds students back from success in subsequent mathematics courses. [bera-journals.onlinelibrary.wiley.com/doi/abs/10.1111/bjet.13139](http://bera-journals.onlinelibrary.wiley.com/doi/abs/10.1111/bjet.13139). [6]

The Power Play below, from Math Force, allows students to interact with and manipulate the number line. Feedback is immediate.

### Power Plays engage students while reinforcing concepts and skills



## Feedback

Feedback takes on many forms from teachers, media, computers, and more. From a teacher, it can be in the form of words, gestures, nods and smiles. It can be verbal or written or mere acknowledgment of right or wrong. It can be immediate, random, or delayed by a specific period of time. Likewise from an electronic source, the style and frequency of feedback can vary widely.

In Math Force feedback is a process that follows students across many activities in the form of confirmation of results, short and long explanations, example demonstration, quizzes, and even in tightly controlled games. In other words, Math Force monitors and checks the student's path to ensure understanding and skill mastery. This is one of the main virtues of Math Force — providing immediate feedback that paves the way to understanding and skill mastery. Research gives strong support to these qualities in Math Force [7, 8, 9]

These four methods — gradual release, scaffolding, use of virtual manipulatives, and feedback — are integrated within Math Force. A well-taught lesson requires all of these attributes.

# Measuring growth with Math Force

Math Force is dedicated to adapting to different students across the grades. The three methodologies built into this product are critical to achieving this goal.

An important byproduct of its many engaging components such as *Try Its*, *Power Plays*, and *Lightning Rounds* enables Math Force to concentrate students' attention in a positive manner. Different avenues to engage students have been tried in field-testing. Only ones that worked are in Math Force. As a result, teachers will be able to teach more and students will learn more. While this strategy is not patently obvious, we know from studies in a variety of settings that the mixture of different learning options offered to students will achieve this goal. [10, 11]

Beyond this objective, we want to measure achievement growth. To that end, we will conduct periodic studies to check on the achievement levels of students. Based on informal results obtained previously, we expect student achievement will grow appreciably.

## References

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