

# Fraction Face-Off!

Intervention Brief | Primary Mathematics Topic Area

WHAT WORKS  
CLEARINGHOUSE™

March 2020

NCEE 2020-005  
U.S. DEPARTMENT OF EDUCATION

*A Publication of the National Center for Education Evaluation at IES*

Understanding fractions is a critical skill for success in school and the workforce, and is often necessary for daily life tasks like distributing work or cooking a meal. Fractions are also an important precursor to other math courses, such as algebra. *Fraction Face-Off!* is a supplemental math program designed to support fourth-grade students who need assistance solving fraction problems. Teachers use program materials with individual students or small groups to promote understanding of the magnitude of fractions, to compare two fractions, to put three fractions in order, and to place fractions on a number line. The program includes 36 lessons, each with four activities: a warm-up problem, group work, a speed game to build fluency, and a worksheet to check

students' understanding. These lessons are designed to be taught three times a week for 12 weeks.

This What Works Clearinghouse (WWC) report, part of the WWC's Primary Mathematics topic area, explores the effects of *Fraction Face-Off!* on mathematics outcome domains including geometry and measurement, number and operations, and general mathematics achievement. The WWC identified one study of *Fraction Face-Off!*, which meets WWC standards. The evidence presented in this report is from one study of the impact of *Fraction Face-Off!* on a racially and ethnically diverse group of fourth-grade students.

## What Happens When Students Participate in *Fraction Face-Off!*?

The evidence indicates that implementing *Fraction Face-Off!*:

- May increase student achievement in geometry and measurement
- May increase student achievement in number and operations
- May increase student achievement in general mathematics achievement

Findings on *Fraction Face-Off!* from one study that meets WWC standards are shown in Table 1. For each outcome reviewed by the WWC, an effectiveness rating, the improvement index, and the number of studies and students that contributed to the findings are presented. The improvement index is a measure of the intervention's effect on an outcome. It can be interpreted as the expected change in percentile rank for an average comparison group student if that student had received the intervention.

**Table 1. Summary of findings on *Fraction Face-Off!* from one study that meets WWC Standards**

Outcome domain	Effectiveness rating	Study Findings	Evidence meeting WWC standards (version 4.0)	
		Improvement index (percentile points)	Number of studies	Number of students
Geometry and measurement	Potentially positive effects	+33	1	212
Number and operations	Potentially positive effects	+31	1	1,152
General mathematics achievement	Potentially positive effects	+24	1	1,152

Note: The improvement index can be interpreted as the expected change in percentile rank for an average comparison group student if that student had received the intervention. For example, an improvement index of +33 means that the expected percentile rank of the average comparison group student would increase by 33 points if the student received *Fraction Face-Off!*. The improvement index values are generated by averaging findings from the outcome analyses that meet WWC standards, as reported by Fuchs et al. (2013). The outcomes in the geometry and measurement domain were only examined in one of the five student cohorts examined in the study and therefore are based on fewer students than the analyses in the number and operations and general mathematics achievement domains. Geometry and measurement outcomes reported in the study include two researcher-designed measures: 1) a fraction magnitude comparison test and 2) a fraction magnitude explanation test. Number and operations outcomes reported in the study include six researcher-designed measures: 1) a test of comparing and representing fractions; 2) a fraction number line test; 3) a test of fraction calculations; 4) a test of word problems requiring multiplication; 5) a test of word problems requiring addition; and 6) a test of word problems requiring fractions. General mathematics achievement outcomes reported in the study include a collection of selected items from the National Assessment of Educational Progress (NAEP). The effects of *Fraction Face-Off!* are not known for other outcomes within the Primary Mathematics topic area, including data analysis, statistics, and probability, and algebra.

## BOX 1. HOW THE WWC REVIEWS AND DESCRIBES EVIDENCE

The WWC evaluates evidence based on the quality and results of reviewed studies. The criteria the WWC uses for evaluating evidence are defined in the [Procedures and Standards Handbooks](#) and the [Review Protocols](#). The studies summarized in this report were reviewed under WWC Standards (version 4.0) and the Primary Mathematics topic area protocol (version 4.0).

To determine the effectiveness rating, the WWC considers what methods each study used, the direction of the effects, and the number of studies that tested the intervention. The higher the effectiveness rating, the more certain the WWC is about the reported results and about what will happen if the same intervention is implemented again. The following key explains the relationship between effectiveness ratings and the statements used in this report:

Effectiveness Rating	Rating interpretation	Description of the evidence
Positive (or negative) effects	The intervention is <i>likely</i> to change an outcome	Strong evidence of a positive effect, with no overriding contrary evidence
Potentially positive (or negative) effects	The intervention <i>may</i> change an outcome	Evidence of a positive effect with no overriding contrary evidence
No discernible effects	The intervention <i>may result in little to no change</i> in an outcome	No affirmative evidence of effects
Mixed effects	The intervention <i>has inconsistent effects</i> on an outcome	Evidence includes studies in at least two of these categories: studies with positive effects, studies with negative effects, or more studies with indeterminate effects than with positive or negative effects

### How is *Fraction Face-Off!* Implemented?

The following section provides details of how *Fraction Face-Off!* was implemented. This information can help educators identify the requirements for implementing *Fraction Face-Off!* and determine whether implementing this program would be feasible in their district or school. Information on *Fraction Face-Off!* presented in this section comes from the one study that meets WWC standards (Fuchs et al., 2013) and from correspondence with the developer.

- **Goal:** *Fraction Face-Off!* aims to support students who need assistance solving fractions.
- **Target population:** *Fraction Face-Off!* is designed for fourth-grade students who have demonstrated difficulty in mathematics.
- **Method of delivery:** Classroom educators, including teachers and paraprofessionals, can deliver *Fraction Face-Off!* to individual students or in small-group settings. The *Fraction Face-Off!* program materials refer to the classroom educator who delivers *Fraction Face-Off!* as a tutor.

**Comparison group:** In the study that contributes to this intervention report, the first cohort of students in the comparison group used the regular district curriculum: Houghton Mifflin Math. Later cohorts used a different curriculum: enVisionMATH.

- **Frequency and duration of service:** The developer recommends students use *Fraction Face-Off!* three times a week for 12 weeks for about 30 minutes per session. It is typically used during class time or during a pull-out time to supplement the math curriculum.
- **Intervention components:** *Fraction Face-Off!* includes a teacher's guide and student worksheets for each lesson. An optional Implementation Ready Pack provides materials that teachers would otherwise have to prepare themselves, such as flashcards and manipulatives. The current version of *Fraction Face-Off!* is the 2015 Revised Edition. Refer to Table 2 for additional details.

**Table 2. Components of *Fraction Face-Off!***

Key component	Description
Group size	<i>Fraction Face-Off!</i> is designed for use with individual students or small groups of up to three students.
Content	<i>Fraction Face-Off!</i> includes 36 lessons delivered over the course of 12 weeks, with each week focusing on specific concepts and skills. The first two weeks of instruction typically focus on building fraction foundations by introducing key vocabulary, such as numerator, denominator, unit; describing the meaning of fractions as one or more equal parts of a single object; and comparing two fractions in which the numerator or denominator are the same. In weeks 3–5, the focus shifts to understanding magnitude reasoning, building fluency with the meaning of fractions, correctly ordering two fractions on a number line spanning 0 to 1, and understanding word problems that require multiplication and addition with fractions. Concepts covered in weeks 6 and 7 include improper fractions, fractions equivalence, placing fractions on a number line spanning 0 to 1, comparing two fractions in which the numerator and denominator both differ, and ordering three fractions from largest to smallest. In weeks 8 and 9, students focus on fraction addition and subtraction. In weeks 10 to 12, there is a cumulative review of all fraction concepts including part-whole concept and measurement interpretations of fractions.
Activities	Each lesson includes four activities: a warm-up word problem, group work during which the teacher demonstrates fraction concepts using explicit instruction, a speed game to build fluency, and a worksheet activity that students complete individually to check their understanding of the fraction concepts. The program involves frequent use of fluency practice using speed tests or flashcards, and conceptual practice requiring students to explain their reasoning about fractions to the group. The program includes ongoing assessment through daily worksheets and a cumulative review during the final three lessons. The program has embedded motivation through a sports theme and a football challenge at the end of the program.
Recommended dosage	The developer recommends three 30- to 35-minute lessons per week for 12 weeks.
Training	<i>Fraction Face-Off!</i> includes up to a week of training for teachers before delivering content to students. In the training workshop, the trainer presents an overview of the program goals and procedures. Procedures are then modeled and practiced for each activity in the first set of topics. Teachers have opportunities to practice techniques and activities in pairs and receive feedback. Once teachers begin delivering <i>Fraction Face-Off!</i> , they attend 1-hour meetings every other week to provide feedback and help solve problems related to any challenges present in the class. Teachers may be certified teachers or paraprofessionals.

### What Does *Fraction Face-Off!* Cost?

This preliminary list of costs is not designed to be exhaustive; rather, it provides educators with an overview of the major resources needed to implement *Fraction Face-Off!*. The program costs described below are based on the information available as of August 2019.

- **Equipment and materials costs:** *Fraction Face-Off!* includes a teacher’s manual (\$40), which provides teachers with all information necessary for implementation and includes supplemental materials in paper format, including worksheets, flashcards, and templates for manipulatives. Alternative formats of the manual are also available on CD or USB flash drive (\$40 each). There is an optional 1-year license (\$10) or a license in perpetuity (\$30). In addition, teachers can purchase manipulatives, including greater-than/less-than cards, flash cards, and a spinner and game wheel for in-class activities, for 12 students (\$50).
- **Personnel costs:** Classroom educators, including teachers and paraprofessionals, can deliver *Fraction Face-Off!*. Before implementing *Fraction Face-Off!*, teachers may

attend up to a week of initial training at their school. An experienced trainer from Vanderbilt University offers the training; training costs range from \$1,500 to \$1,800 plus travel expenses for the trainer.

- **Facilities costs:** Schools will need to make copies of materials and provide manipulatives for all participating students. The developer recommends that teachers laminate materials for reuse. If the intervention is not implemented in the student’s regular classroom, schools must provide classroom space.
- **Costs paid by students or parents:** Students and their parents do not pay to access *Fraction Face-Off!*.
- **In-kind supports:** No information is available.
- **Sources of funding:** School districts or schools usually purchase *Fraction Face-Off!* and pay for the teacher training costs.

## For More Information:

### About *Fraction Face-Off!*

Vanderbilt University, PMB #228, 110 Magnolia Circle, Suite MRL 418, Nashville, TN 37203-5721

Attn: Lynn Davies

Email: [lynn.a.davies@vanderbilt.edu](mailto:lynn.a.davies@vanderbilt.edu) Web: <https://frg.vkcsites.org/> Phone: (615) 343-4782

### About the cost of the intervention


Web: <https://frg.vkcsites.org/>

## In What Context Was *Fraction Face-Off!* Studied?

The following section provides information on the setting of the one study of *Fraction Face-Off!* that meets WWC standards, and a description of the participants in the research. This information can help educators understand

the context in which the study of *Fraction Face-Off!* was conducted, and determine whether the program might be suitable for their setting.

### WHERE THE STUDY WAS CONDUCTED

 1 study, 1,152 students in at least 14 elementary schools in 1 district.

#### Race



#### Ethnicity



Free & Reduced-Price Lunch: 88%

Special Education: 10%

Gender: 55% Female  
45% Male

Grades

PK

K

1

2

3



4

5

6

7

8

9

10

11

12

PS

Grade 4



## LEARN MORE



Read more about the *Fraction Face-Off!* intervention and the studies that are summarized here in the [Intervention Report](#).