

Unit 4 Develop Understanding of Fractions as Numbers

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Develop Understanding of Fractions as Numbers

Department of Curriculum and Instruction



Belleville Public Schools

Curriculum Guide

Math, Third Grade

Unit 4: Develop Understanding of Fractions as Numbers

Belleville Board of Education

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Unit Overview

Topic 11 Use Operations with Whole Numbers to Solve Problems

- Solve 2-Step Word Problems: Addition and Subtraction
- Solve 2-Step Word Problems: Multiplication and Division
- Solve 2-Step Word Problems: All Operations

Topic 12 Understand Fractions as Numbers

- Divide Regions into Equal Parts
- Fractions and Regions
- Understand the Whole
- Number Line: Fractions Less Than 1
- Number Line: Fractions Greater Than 1
- Line Plots and Length
- More Line Plots and Length

Topic 13 Fraction Equivalences and Comparison

- Equivalent Fractions: Use Models
- Equivalent Fractions: Use the Number Line
- Use Models to Compare Fractions: Same Numerator
- Compare Fractions: Use Benchmarks
- Compare Fractions: Use Number Line
- Whole Numbers and Fractions

Topic 14 Solve Time, Capacity, and Mass Problems

- Time to the Minute
- Units of Time: Measure Elapsed Time
- Units of Time: Solve Word Problems
- Estimate Liquid Volume
- Measure Liquid Volume
- Estimate Mass
- Measure Mass
- Solve Word Problems Involving Mass and Liquid Volume

NJSLS

Below are the New Jersey Student Learning Standards associated with the student learning objectives for Unit 4; in addition, the Mathematical Practices (the habits of mind, processes, and dispositions that enable a learner to understand mathematics and to use or do mathematics with understanding) are listed below:

MA.3.G.A.2	Partition shapes into parts with equal areas. Express the area of each part as a unit fraction of the whole.
MA.3.MD.B.4	Generate measurement data by measuring lengths using rulers marked with halves and fourths of an inch. Show the data by making a line plot, where the horizontal scale is marked off in appropriate units— whole numbers, halves, or quarters.
MA.3.NF.A	Develop understanding of fractions as numbers.
MA.3.NF.A.1	Understand a fraction $1/b$ as the quantity formed by 1 part when a whole is partitioned into b equal parts; understand a fraction a/b as the quantity formed by a parts of size $1/b$.
MA.3.NF.A.2	Understand a fraction as a number on the number line; represent fractions on a number line diagram.
MA.3.NF.A.3	Explain equivalence of fractions in special cases, and compare fractions by reasoning about their size.
MA.3.NF.A.2a	Represent a fraction $1/b$ on a number line diagram by defining the interval from 0 to 1 as the whole and partitioning it into b equal parts. Recognize that each part has size $1/b$ and that the endpoint of the part based at 0 locates the number $1/b$ on the number line.
MA.3.NF.A.2b	Represent a fraction a/b on a number line diagram by marking off a lengths $1/b$ from 0. Recognize that the resulting interval has size a/b and that its endpoint locates the number a/b on the number line.
MA.3.NF.A.3c	Express whole numbers as fractions, and recognize fractions that are equivalent to whole numbers.
MA.3.OA.D.8	Solve two-step word problems using the four operations. Represent these problems using equations with a letter standing for the unknown quantity. Assess the reasonableness of answers using mental computation and estimation strategies including rounding.

Exit Skills

By the end of Grade 3 Mathematics, students in the Belleville Public Schools will be able to:

- Develop an understanding of multiplication and division and strategies for multiplication and division

within 100. Students will also work toward fluency in addition and subtraction within 1,000 and multiplication and division within 100. In addition, students will know all products of two one-digit numbers from memory:

Students develop an understanding of the meanings of multiplication and division of whole numbers through activities and problems involving equal-sized groups, arrays, and area models; multiplication is finding an unknown product, and division is finding an unknown factor in these situations. For equal-sized group situations, division can require finding the unknown number of groups or the unknown group size. Students use properties of operations to calculate products of whole numbers, using increasingly sophisticated strategies based on these properties to solve multiplication and division problems involving single-digit factors. By comparing a variety of solution strategies, students learn the relationship between multiplication and division.

- Develop an understanding of fractions, especially unit fractions (fractions with numerator 1):

Students develop an understanding of fractions, beginning with unit fractions. Students view fractions in general as being built out of unit fractions, and they use fractions along with visual fraction models to represent parts of a whole. Students understand that the size of a fractional part is relative to the size of the whole. For example, $\frac{1}{2}$ of the paint in a small bucket could be less paint than $\frac{1}{3}$ of the paint in a large bucket, but $\frac{1}{3}$ of a ribbon is longer than $\frac{1}{5}$ of the same ribbon because when the ribbon is divided into 3 equal parts, the parts are longer than when the ribbon is divided into 5 equal parts. Students are able to use fractions to represent numbers equal to, less than, and greater than one. They solve problems that involve comparing fractions by using visual fraction models and strategies based on noticing equal numerators or denominators.

- Develop an understanding of the structure of rectangular arrays and of area:

Students recognize area as an attribute of two-dimensional regions. They measure the area of a shape by finding the total number of same-size units of area required to cover the shape without gaps or overlaps, a square with sides of unit length being the standard unit for measuring area. Students understand that rectangular arrays can be decomposed into identical rows or into identical columns. By decomposing rectangles into rectangular arrays of squares, students connect area to multiplication and justify using multiplication to determine the area of a rectangle.

Enduring Understanding

Topic 11 Use Operations with Whole Numbers to Solve Problems

- Bar diagrams show relationships in a two-step word problem and help identify the operation or operations needed to solve the problem.
- The way quantities in a two-step problem are related determines the operations used to solve the problem. Equations show these relationships.
- Good math thinkers use math to explain why they are right. They can talk about the math that others do, too.

Topic 12 Understand Fractions as Numbers

- A unit fraction represents one part of a whole that has been divided into equal parts. A fraction can represent multiple copies of a unit fraction.

- The whole can be found given a fractional part.
- Points on a number line can represent fractions. The denominator represents the number of equal parts between 0 and 1 and the numerator represents the number of parts between 0 and the point.
- A number line can be used to represent fractions greater than 1.
- A line plot is a way to organize data on a number line.
- Good math thinkers make sense of problems and think of ways to solve them. If they get stuck, they don't give up.

Topic 13 Fraction Equivalence and Comparison

- The same fractional amount can be represented by an infinite set of different but equivalent fractions.
- There are a limitless number of fraction names for each point on a number line. These points can be used to name equivalent fractions.
- If two fractions have the same denominator, the fraction with the greater numerator is the greater fraction.
- If two fractions have the same numerator, the fraction with the greater denominator is less than the other fraction.
- Benchmark numbers such as 0, $\frac{1}{2}$, and 1 can be used to compare fractions.
- You can use a number line to compare fractions.
- Whole numbers can be represented by many different fraction names.
- Good math thinkers use math to explain why they are right. They can talk about math that others do, too.

Topic 14 Solve Time, Capacity, and Mass Problems

- Clocks can be used to tell time to the nearest minute.
- Elapsed time can be found by finding the total amount of time that passes between a starting time and an ending time.
- Time intervals can be added or subtracted to solve problems.
- Benchmarks can be used to estimate capacity (liquid volume).
- Capacity (liquid volume) is a measure of the amount of liquid a container can hold.
- Mass is a measure of the quantity of matter in an object.
- Problems involving mass and volume can often be solved with a picture or a diagram.
- Good math thinkers know how to think about words and numbers to solve problems.

Essential Questions

Topic 11 Use Operations with Whole Numbers to Solve Problems

- What are ways to solve two-step problems?

Topic 12 Understand Fractions of Numbers

- What are different interpretations of a fraction?

Topic 13 Fraction Equivalence and Comparison

- What are different ways to compare fractions?

Topic 14 Solve Time, Capacity, and Mass Problems

- How can time, capacity, and mass be measured and found?

Learning Objectives

Topic 11 Use Operations with Whole Numbers to Solve Problems

- Students will be able to draw diagrams and write equations to solve two-step problems involving addition and subtraction of whole numbers.
- Students will be able to examine relationships between quantities in a two-step word problem by writing equations. Choose and apply the operations needed to find the answer.
- Students will be able to critique the reasoning of others by asking questions, identifying mistakes, and providing suggestions for improvement.

Topic 12 Understand Fractions as Numbers

- Students will be able to understand how to read and write fractions for equally sized parts of a region.
- Students will be able to use a fraction to represent multiple copies of a unit fraction.
- Students will be able to determine and draw the whole (unit) given one part (unit fraction).
- Students will be able to label fractions on a number line.
- Students will be able to label fractions greater than 1 on a number line.
- Students will be able to measure length to the nearest fourth inch and show the data on a line plot.
- Students will be able to measure length to the nearest half inch and show the data on a line plot.
- Students will be able to determine when a problem has either extra or missing information.

Topic 13 Fraction Equivalence and Comparison

- Students will be able to find equivalent fractions that name the same part of the whole.
- Students will be able to represent equivalent fractions on a number line.
- Students will be able to use models such as fraction strips to compare fractions that refer to the same

whole and have the same denominator.

- Students will be able to use models such as fractions strips to compare fractions that refer to the same whole and have the same numerator.
- Students will be able to use benchmark numbers to compare fractions.
- Students will be able to use a number line to compare fractions.
- Students will be able to use fraction names to represent whole numbers.
- Students will be able to construct math arguments using fractions.

Topic 14 Solve Time, Capacity, and Mass Problems

- Students will be able to show and tell time to the nearest minute using analog and digital clocks.
- Students will be able to tell and write time to the nearest minute and measure time intervals in minutes.
- Students will be able to solve word problems involving addition and subtraction to measure quantities of time.
- Students will be able to use standard units to estimate liquid volume.
- Students will be able to use standard units to estimate the masses of solid objects.
- Students will be able to use a pan balance with metric weights to measure the mass of objects in grams and kilograms.
- Students will be able to use pictures to help solve problems about mass and volume.
- Students will be able to make sense of quantities and relationships in problems.

Interdisciplinary Connections

Math and Science Project STEM

Topic 11 Use Operations with Whole Numbers to Solve Problems

The science theme for this topic is engineering design.

- Ask students to talk about different designs for kites.
- Discuss the different materials that kites can be made from.
- Talk about how the size of the kite and the different materials would change the cost of making the kite.
- Have students research kite designs.
- Have students write a report/journal entry detailing the information they found.

Topic 12 Understand Fractions as Numbers

The science theme for this topic is fossils and environment.

- Discuss fossils.
- Have students select a fossil to study.
- Have students draw posters of their chosen fossil or to create a diorama depicting the fossil in its original environment.
- Have the students write a report/journal entry comparing and contrasting that environment to today's environment.

Topic 13 Fraction Equivalence and Comparison

The science theme for this topic is life cycles.

- Have students discuss the image on page 669.
- Have the student write a journal entry explaining the life cycle that all animals have in common.

Topic 14 Solve Time, Capacity, and Mass Problems

The science theme for this topic is forces and interaction.

- Explain to students that a magnetic field is invisible to the human eye. Magnetism can attract magnetic objects.
- Explain that magnets have a north pole and a south pole. Objects of the same pole will push away from each other. While objects from opposite poles will attract each other.
- Have students experiment with magnets.
- Have the students research the types of magnets and write a report/journal entry on the information gathered.

LA.K-12.NJSLSA.R

Reading

LA.K-12.NJSLSA.W

Writing

SCI.3-5-ETS1

Engineering Design

TECH.8.1.5

Educational Technology: All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge.

Alignment to 21st Century Skills & Technology

Key SUBJECTS AND 21st CENTURY THEMES

Mastery of key subjects and 21st century themes is essential for all students in the 21st century.

Key subjects include:

- English, reading or language arts
- World languages
- Arts
- Mathematics
- Economics
- Science
- Geography
- History
- Government and Civics

21st Century/Interdisciplinary Themes

- Civic Literacy

- Environmental Literacy
- Financial, Economic, Business and Entrepreneurial Literacy
- Global Awareness
- Health Literacy

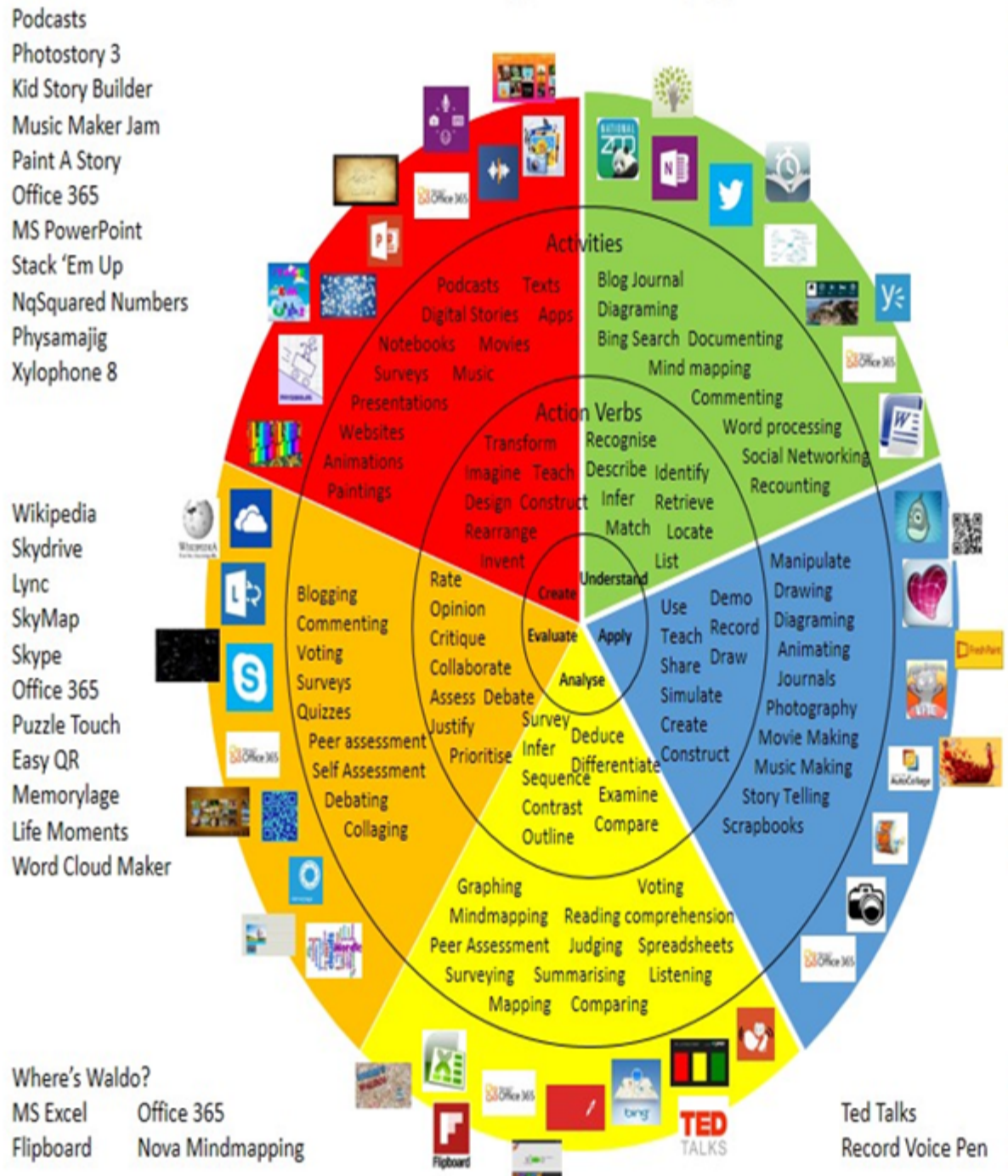
21st Century Skills

- Communication and Collaboration
- Creativity and Innovation
- Critical thinking and Problem Solving
- ICT (Information, Communications and Technology) Literacy
- Information Literacy
- Life and Career Skills
- Media Literacy

Technology Infusion

What technology can be used in this unit to enhance learning?

Originally taken from <http://www.coetail.com/vzimmer/files/2013/02/iPadagogy-Wheel.001.jpg>
And adapted for Windows 8.1 devices by Charlotte Beckhurst @CharBeckhurst



enVision Math 2.0 Differentiated Instruction

Ongoing Intervention

- During the core lesson, monitor progress, reteach as needed, and extend students' thinking.
- Utilize the Guiding Questions found in the Teacher's Edition Guide during the lesson.

Strategic Intervention

- At the end of the lesson, assess to identify students' strengths and needs and then provide appropriate support.
- Provide extra and differentiated practice via the On-Level and Advanced Activity Centers

Intensive Intervention

- As needed, provide more instruction that is on or below grade level for students who are struggling.
- Utilize the Math Diagnosis and Intervention System 2.0

English Language Learners

- Provide ELL support through visual learning throughout the program, ELL instruction in every lesson, and additional ideas in an ELL Toolkit.

Math Vocabulary

- Build math vocabulary using the vocabulary cards, vocabulary activities, vocabulary review, and glossary plus the online glossary and vocabulary game.

Math and Reading

- Connect reading and math using a data-filled reading mat for the topic with accompanying activity masters and guide.

Special Education

- printed copy of board work/notes provided
- additional time for skill mastery
- assistive technology
- behavior management plan
- Center-Based Instruction

- check work frequently for understanding
- computer or electronic device utilizes
- extended time on tests/ quizzes
- have student repeat directions to check for understanding
- highlighted text visual presentation
- modified assignment format
- modified test content
- modified test format
- modified test length
- multiple test sessions
- multi-sensory presentation
- preferential seating
- preview of content, concepts, and vocabulary
- reduced/shortened reading assignments
- Reduced/shortened written assignments
- secure attention before giving instruction/directions
- shortened assignments
- student working with an assigned partner
- teacher initiated weekly assignment sheet
- Use open book, study guides, test prototypes

ELL

- teaching key aspects of a topic. Eliminate nonessential information
- using videos, illustrations, pictures, and drawings to explain or clarify
- allowing products (projects, timelines, demonstrations, models, drawings, dioramas, poster boards, charts, graphs, slide shows, videos, etc.) to demonstrate student's learning;
- allowing students to correct errors (looking for understanding)
- allowing the use of note cards or open-book during testing
- modifying tests to reflect selected objectives
- providing study guides
- reducing the number of answer choices on a multiple choice test
- tutoring by peers

Intervention Strategies

- allowing students to correct errors (looking for understanding)
- teaching key aspects of a topic. Eliminate nonessential information
- allowing products (projects, timelines, demonstrations, models, drawings, dioramas, poster boards, charts, graphs, slide shows, videos, etc.) to demonstrate student's learning

- allowing students to select from given choices
- allowing the use of note cards or open-book during testing
- collaborating (general education teacher and specialist) to modify vocabulary, omit or modify items to reflect objectives for the student, eliminate sections of the test, and determine how the grade will be determined prior to giving the test.
- decreasing the amount of work presented or required
- having peers take notes or providing a copy of the teacher's notes
- marking students' correct and acceptable work, not the mistakes
- modifying tests to reflect selected objectives
- providing study guides
- reducing or omitting lengthy outside reading assignments
- reducing the number of answer choices on a multiple choice test
- tutoring by peers
- using authentic assessments with real-life problem-solving
- using true/false, matching, or fill in the blank tests in lieu of essay tests
- using videos, illustrations, pictures, and drawings to explain or clarify

Evidence of Student Learning-CFU's

Please list ways educators may effectively check for understanding in this section.

- Admit Tickets
- Anticipation Guide
- Common benchmarks
- Compare & Contrast
- Create a Multimedia Poster
- Define
- Describe
- Evaluate
- Evaluation rubrics
- Exit Tickets
- Explaining
- Fist- to-Five or Thumb-Ometer
- Illustration
- Journals
- KWL Chart
- Newspaper Headline
- Outline
- Question Stems
- Quickwrite
- Quizzes

- Red Light, Green Light
- Self- assessments
- Socratic Seminar
- Study Guide
- Teacher Observation Checklist
- Think, Pair, Share
- Think, Write, Pair, Share
- Top 10 List
- Unit tests

Primary Resources

- ELL Kit
- enVision Math 2.0 Centers
- Intervention Kit
- Teacher's Guide

Ancillary Resources

Please list ALL other resources available to strengthen your lesson.

- Grade Level Curriculum Guide
- Model Curriculum