Overview
There is a number study for each common fraction, decimal, and percent. The purpose of number studies is to strengthen student’s proportional reasoning, connections, and flexibility as they explore equivalent forms, representations, and real world examples of the chosen number. I scatter the number studies throughout the units on fractions, decimals, and percent. Every time students complete a number study, I like to post the Triangle Equivalency on the classroom wall and let the list grow throughout the semester.

Using ¾ as an Example
It is important for students to understand ¾, 6/8, 9/12, 0.75, 75%, and three-fourths are numbers with equal value. This can be difficult for students because these numbers look so different. For instance, 75% can be challenging for students because it looks like a “large” number or a number greater than 1 whole.

Though all the numbers under the Equivalent Forms of ¾ section are equal, the representations of ¾ may vary in size, depending on what you are taking ¾ of. Representation #2 may be difficult for those who are used to one circle representing a whole. To facilitate the learning of students who are having this type of difficulty, it may be helpful to put the problem in context. For example, you may say, “Imagine the two circles are two cupcakes that come packaged together. Draw what ¾ of a package looks like.”

Representation #3 is a chance for students to recall that fractions do not always express a part-whole comparison. Sometimes they may be a ratio that is a part-part comparison. In this case, comparing the part of the group that is girls to the part of the group that is boys.

To introduce this number study, you may say, “A number study focuses on one number, in this case ¾. It looks at equivalent forms, multiple representations, and real world examples.” And then indicate what resources are available to students and where they are located. When we’re doing our first number study I sometimes get a lot of questions. I answer those about directions but hold back from helping students to solve any of the problems. However as I walk around I may ask:

• (pointing to two equivalent forms) Are these numbers the same size? How can you be sure? Can you prove it or explain why it makes sense?
• How did you know where to mark the number line for ¾? Is ¾ closer to the ½ mark or to the whole mark? How do you know?
• What was your method for drawing this group of girls and boys so that ratio came out to be 3:4?
• How many books did ¾ of the group come out to be?

Sometimes I have student complete the last section “¾ in the Real World” in class, and some times as homework. Afterwards we discuss the number study as a class focusing on the different methods and reasoning students used. And then, of course, we post the Triangle Equivalence on the classroom wall.
Number Study: $\frac{3}{4}$

**Equivalent Forms of $\frac{3}{4}$**
Numbers can look different and still be the same number. In this Number Study we will look at all the different ways $\frac{3}{4}$ may appear. Remember even though these numbers may look different, they are all equal to $\frac{3}{4}$.

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<tbody>
<tr>
<td>Write at least 5 equivalent fraction forms.</td>
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</tbody>
</table>

**Representations of $\frac{3}{4}$**
Now we will look at different representations of $\frac{3}{4}$. Keep in mind unlike the numbers above, these pictures may not represent amounts that are the same size. It all depends what you are taking $\frac{3}{4}$ of.

Show $\frac{3}{4}$ on a number line.

![Number line](image)

The ratio 3:4 can be written $\frac{3}{4}$. Draw a picture that shows a ratio of 3 girls to every 4 boys and has more than 20 total people.

Shade in $\frac{3}{4}$ of these books.

**$\frac{3}{4}$ in the Real World**
Find an example of $\frac{3}{4}$ in the real world. When possible, glue the example to the bottom of this paper; when not, describe where you found $\frac{3}{4}$. 

Encouraging Mathematical Reasoning
75% = 0.75 = 3/4
**Number Study: 25%**

**Equivalent Forms of 25%**
Numbers can look different and still be the same number. In this Number Study we will look at all the different ways 25% may appear. Remember even though these numbers may look different, they are all equal to 25%.

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</tbody>
</table>

**Representations of 25%**
Now we will look at different representations of 25%. Keep in mind unlike the numbers above, these pictures may not represent amounts that are the same size. It all depends what you are taking 25% of.

Shade 25% of the square.

![Shade 25% of the square](image)

100% =

25% =

Label 25% on this percent strip and figure out how many kilograms are in 25%.

0% 30% 100%

0 kg 60 kg

Here is the money in Analisa’s pocket. She’d like to spend 25% of it on candy. How much money is that?

$5 $5 $5 $1 $1 $20 $20

**25% in the Real World**
Find an example of 25% in the real world. When possible, glue the example to the bottom of this paper; when not, describe where you found 25%.
25% = 0.25 = \frac{1}{4}
Number Study: $\frac{1}{2}$

**Equivalent Forms of $\frac{1}{2}$**
Numbers can look different and still be the same number. In this Number Study we will look at all the different ways $\frac{1}{2}$ may appear. Remember even though these numbers may look different, they are all equal to $\frac{1}{2}$.

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</thead>
<tbody>
<tr>
<td>Write at least 5 equivalent fraction forms.</td>
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</tbody>
</table>

**Representations of $\frac{1}{2}$**
Now we will look at different representations of $\frac{1}{2}$. Keep in mind unlike the numbers above, these pictures may not represent amounts that are the same size. It all depends what you are taking $\frac{1}{2}$ of.

The ratio 1:2 can be written $\frac{1}{2}$. Draw a picture that shows a ratio of 1 circle to every 2 squares and has more than 20 total shapes.

1 whole =

$\frac{1}{2}$ =

Show $\frac{1}{2}$ on a number line.

Circle $\frac{1}{2}$ of these x's.

$\frac{1}{2}$ in the Real World
Find an example of $\frac{1}{2}$ in the real world. When possible, glue the example to the bottom of this paper; when not, describe where you found $\frac{1}{2}$. 
50% = 0.50 = \frac{1}{2}
Number Study: \(\frac{1}{3}\)

**Equivalent Forms of \(\frac{1}{3}\)**
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**Representations of \(\frac{1}{3}\)**
Now we will look at different representations of \(\frac{1}{3}\). Keep in mind unlike the numbers above, these pictures may not represent amounts that are the same size. It all depends what you are taking \(\frac{1}{3}\) of.

Show \(\frac{1}{3}\) on the number line.

\[0 \quad \frac{1}{3} \]

\(\frac{2}{3} = \)

\[\frac{1}{3} = \]

Write a word whose letters are \(\frac{1}{3}\) vowels.

Circle in \(\frac{1}{3}\) of the stars.

**\(\frac{1}{3}\) in the Real World**
Find an example of \(\frac{1}{3}\) in the real world. When possible, glue the example to the bottom of this paper; when not, describe where you found \(\frac{1}{3}\).
$33\frac{1}{3}\% = 0.\overline{3} = \frac{1}{3}$
Number Study: \( \frac{2}{3} \)

**Equivalent Forms of \( \frac{2}{3} \)**

Numbers can look different and still be the same number. In this Number Study we will look at all the different ways \( \frac{2}{3} \) may appear. Remember even though these numbers may look different, they are all equal to \( \frac{2}{3} \).

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</table>

**Representations of \( \frac{2}{3} \)**

Now we will look at different representations of \( \frac{2}{3} \). Keep in mind unlike the numbers above, these pictures may not represent amounts that are the same size. It all depends what you are taking \( \frac{2}{3} \) of.

Show \( \frac{2}{3} \) on the number line.

\[
\begin{array}{cc}
0 & 2 \\
\end{array}
\]

\( \frac{2}{3} = \)

Shade \( \frac{2}{3} \) of the circle.

\[
\text{Add hearts so that } \frac{2}{3} \text{ of the shapes are pentagons.}
\]

\( \frac{2}{3} \) in the Real World

Find an example of \( \frac{2}{3} \) in the real world. When possible, glue the example to the bottom of this paper; when not, describe where you found \( \frac{2}{3} \).
$66\frac{2}{3}\%$
Number Study: \( \frac{1}{8} \)

**Equivalent Forms of \( \frac{1}{8} \)**

Numbers can look different and still be the same number. In this Number Study we will look at all the different ways \( \frac{1}{8} \) may appear. Remember even though these numbers may look different, they are all equal to \( \frac{1}{8} \).

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**Representations of \( \frac{1}{8} \)**

Now we will look at different representations of \( \frac{1}{8} \). Keep in mind unlike the numbers above, these pictures may not represent amounts that are the same size. It all depends what you are taking \( \frac{1}{8} \) of.

Show \( \frac{1}{8} \) on the number line.

---

Use yellow and blue color tiles to make a rectangle that is \( \frac{1}{8} \) yellow. Sketch the rectangle below. Then make a different yellow and blue rectangle that is also \( \frac{1}{8} \) yellow. Sketch it here as well.

---

Shade \( \frac{1}{8} \) of the circle.

---

\( \frac{1}{8} \) in the Real World

Find an example of \( \frac{1}{8} \) in the real world. When possible, glue the example to the bottom of this paper; when not, describe where you found \( \frac{1}{8} \).
12.5% = 0.125 = \frac{1}{8}
Number Study: \(\frac{3}{8}\)

Equivalent Forms of \(\frac{3}{8}\)

Numbers can look different and still be the same number. In this Number Study we will look at all the different ways \(\frac{3}{8}\) may appear. Remember even though these numbers may look different, they are all equal to \(\frac{3}{8}\).

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Representations of \(\frac{3}{8}\)

Now we will look at different representations of \(\frac{3}{8}\). Keep in mind unlike the numbers above, these pictures may not represent amounts that are the same size. It all depends what you are taking \(\frac{3}{8}\) of.

Show \(\frac{3}{8}\) on the number line.

\[\begin{array}{c}
0 \\
\frac{1}{2}
\end{array}\]

Add diamonds so that \(\frac{3}{8}\) of the shapes are hearts.

\[\begin{array}{c}
\begin{array}{c}
\Diamond \quad \Diamond \quad \Diamond \quad \Diamond \\
\heart \quad \heart \quad \heart \quad \heart
\end{array}
\end{array}\]

\(\frac{3}{8}\) in the Real World

Find an example of \(\frac{3}{8}\) in the real world. When possible, glue the example to the bottom of this paper; when not, describe where you found \(\frac{3}{8}\).

Create a line plot below for a class of more than 15 students \(\frac{3}{8}\) of whom have their birthday during the summer (June, July, or August).

When is your Birthday?
$37.5\% = 0.375 = \frac{3}{8}$
Number Study: $\frac{5}{8}$

**Equivalent Forms of $\frac{5}{8}$**
Numbers can look different and still be the same number. In this Number Study we will look at all the different ways $\frac{5}{8}$ may appear. Remember even though these numbers may look different, they are all equal to $\frac{5}{8}$.

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</table>

**Representations of $\frac{5}{8}$**
Now we will look at different representations of $\frac{5}{8}$. Keep in mind unlike the numbers above, these pictures may not represent amounts that are the same size. It all depends what you are taking $\frac{5}{8}$ of.

Show $\frac{5}{8}$ on a number line.

![Number Line](image)

1 =

$\frac{5}{8} =$

The ratio 5:8 can be written $\frac{5}{8}$. Draw a picture that shows a ratio of 5 moons to every 8 stars and has more than 19 objects.

Shade in $\frac{5}{8}$ of these circles.

**$\frac{5}{8}$ in the Real World**
Find an example of $\frac{5}{8}$ in the real world. When possible, glue the example to the bottom of this paper; when not, describe where you found $\frac{5}{8}$. 
Encouraging Mathematical Reasoning

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Number Study: 40%

**Equivalent Forms of 40%**
Numbers can look different and still be the same number. In this Number Study we will look at all the different ways 40% may appear. Remember even though these numbers may look different, they are all equal to 40%.

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<tbody>
<tr>
<td>Write at least 5 equivalent fraction forms.</td>
<td></td>
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<td></td>
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</tbody>
</table>

**Representations of 40%**
Now we will look at different representations of 40%. Keep in mind unlike the numbers above, these pictures may not represent amounts that are the same size. It all depends what you are taking 40% of.

Label 40% on this percent strip and figure out how many inches are in 40%.

<table>
<thead>
<tr>
<th>0%</th>
<th>30%</th>
<th>100%</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 in</td>
<td>18 in</td>
<td></td>
</tr>
</tbody>
</table>

Shade in 40% of the octagons.

Create a Venn Diagram below for a class of more than 17 students 40% of whom have just dogs.

- **40% in the Real World**
  Find an example of 40% in the real world. When possible, glue the example to the bottom of this paper; when not, describe where you found 40%.
40% = 0.40 = \frac{2}{5}
Number Study: \( \frac{7}{10} \)

**Equivalent Forms of \( \frac{7}{10} \)**
Numbers can look different and still be the same number. In this Number Study we will look at all the different ways \( \frac{7}{10} \) may appear. Remember even though these numbers may look different, they are all equal to \( \frac{7}{10} \).

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</thead>
<tbody>
<tr>
<td>Write at least 5 equivalent fraction forms.</td>
<td></td>
<td></td>
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</table>

**Representations of \( \frac{7}{10} \)**
Now we will look at different representations of \( \frac{7}{10} \). Keep in mind unlike the numbers above, these pictures may not represent amounts that are the same size. It all depends what you are taking \( \frac{7}{10} \) of.

Show \( \frac{7}{10} \) on the number line.

\[ \begin{array}{c}
0 \\
1 \quad 2 
\end{array} \]

If the orange color rod is 1-whole, which color rod is \( \frac{7}{10} \)? Explain.

Divide the plot of land below so that Liam gets \( \frac{7}{10} \) of it and the rest is reserved for wildlife conservation.

Circle \( \frac{7}{10} \) of the stars.

**\( \frac{7}{10} \) in the Real World**
Find an example of \( \frac{7}{10} \) in the real world. When possible, glue the example to the bottom of this paper; when not, describe where you found \( \frac{7}{10} \).
70% = 0.70 = 7/10
Number Study: 0.2

Equivalent Forms of 0.2
Numbers can look different and still be the same number. In this Number Study we will look at all the different ways 0.2 may appear. Remember even though these numbers may look different, they are all equal to 0.2.

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<tbody>
<tr>
<td>Write at least 5 equivalent fraction forms.</td>
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</table>

Representations of 0.2
Now we will look at different representations of 0.2. Keep in mind unlike the numbers above, these pictures may not represent amounts that are the same size. It all depends what you are taking 0.2 of.

Show 0.2 on the number line.

\[ 0 \quad 0.8 \]

If the orange color rod is 1.0, which color rod is 0.2? Explain.

Shade 0.2 of the circle.

If the yellow color rod is 1.0, which color rod is 0.2? Explain.

0.2 in the Real World
Find an example of 0.2 in the real world. When possible, glue the example to the bottom of this paper; when not, describe where you found 0.2.
20% = 0.20 = \frac{1}{5}
Number Study: 30%

Equivalent Forms of 30%
Numbers can look different and still be the same number. In this Number Study we will look at all the different ways 30% may appear. Remember even though these numbers may look different, they are all equal to 30%.

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Representations of 30%
Now we will look at different representations of 30%. Keep in mind unlike the numbers above, these pictures may not represent amounts that are the same size. It all depends what you are taking 30% of.

Label 30% on this percent strip and figure out how many beans are in 30%.

0% 50% 100%
o in 30 beans

Shade in 30% of the trapezoids.

Create a Venn Diagram below for a class of more than 17 students 30% of whom have no brothers or sisters.

Do You Have Brother(s), Sister(s), Both, or Neither?

30% in the Real World
Find an example of 30% in the real world. When possible, glue the example to the bottom of this paper; when not, describe where you found 30%.
ENCOURAGING MATHEMATICAL REASONING

NUMBER STUDY: 30% - TRIANGLE EQUIVALENCY

Encouraging Mathematical Reasoning

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Number Study: \( \frac{7}{8} \)

**Equivalent Forms of \( \frac{7}{8} \)**
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<tbody>
<tr>
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**Representations of \( \frac{7}{8} \)**
Now we will look at different representations of \( \frac{7}{8} \). Keep in mind unlike the numbers above, these pictures may not represent amounts that are the same size. It all depends what you are taking \( \frac{7}{8} \) of.

Show \( \frac{7}{8} \) on a number line.

\[
\begin{array}{ccc}
0 & \frac{1}{2} & 1
\end{array}
\]

The ratio 7:8 can be written \( \frac{7}{8} \). Draw a picture that shows a ratio of 7 heart to every 8 stars and has more than 9 objects.

Shade in \( \frac{7}{8} \) of these circles.

**\( \frac{7}{8} \) in the Real World**
Find an example of \( \frac{7}{8} \) in the real world. When possible, glue the example to the bottom of this paper; when not, describe where you found \( \frac{7}{8} \).
87.5% = \frac{7}{8} = 0.875
Number Study: 80%

Equivalent Forms of 80%
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<tbody>
<tr>
<td>Write at least 5 equivalent fraction forms.</td>
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</table>

Representations of 80%
Now we will look at different representations of 80%. Keep in mind unlike the numbers above, these pictures may not represent amounts that are the same size. It all depends what you are taking 80% of.

Shade 80% of the square.

100% =

80% =

Label 80% on this percent strip and figure out how many centimeters are in 80%.

<table>
<thead>
<tr>
<th>0%</th>
<th>30%</th>
<th>100%</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 kg</td>
<td>12 cm</td>
<td></td>
</tr>
</tbody>
</table>

Here is the money in Fred’s pocket. He'd like to spend 80% of it on new shoes. How much money is that?

80% in the Real World
Find an example of 80% in the real world. When possible, glue the example to the bottom of this paper; when not, describe where you found 80%.
80% = 0.80 = \frac{4}{5}
Number Study: 10%

Equivalent Forms of 10%
Numbers can look different and still be the same number. In this Number Study we will look at all the different ways 10% may appear. Remember even though these numbers may look different, they are all equal to 10%.

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<tbody>
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Representations of 10%
Now we will look at different representations of 10%. Keep in mind unlike the numbers above, these pictures may not represent amounts that are the same size. It all depends what you are taking 10% of.

Shade 10% of the square.

Add diamonds so that 10% of the shapes are hearts.

10% in the Real World
Find an example of 10% in the real world. When possible, glue the example to the bottom of this paper; when not, describe where you found 10%.

Create a line plot below for a class of more than 17 students 10% of whom have the favorite color yellow.

What is your favorite color?

<table>
<thead>
<tr>
<th>red</th>
<th>orange</th>
<th>yellow</th>
<th>green</th>
<th>blue</th>
<th>purple</th>
</tr>
</thead>
<tbody>
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<td></td>
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<td></td>
<td></td>
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</tbody>
</table>
10% = 0.10 = \frac{1}{10}
**Number Study: \( \frac{3}{5} \)**

**Equivalent Forms of \( \frac{3}{5} \)**

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**Representations of \( \frac{3}{5} \)**

Now we will look at different representations of \( \frac{3}{5} \). Keep in mind unlike the numbers above, these pictures may not represent amounts that are the same size. It all depends what you are taking \( \frac{3}{5} \) of.

Show \( \frac{3}{5} \) on the number line.

\[
\begin{array}{ccc}
0 & \frac{3}{5} & \text{ } \\
\end{array}
\]

Write a word whose letters are \( \frac{3}{5} \) consonants.

Circle in \( \frac{3}{5} \) of the stars.

**\( \frac{3}{5} \) in the Real World**

Find an example of \( \frac{3}{5} \) in the real world. When possible, glue the example to the bottom of this paper; when not, describe where you found \( \frac{3}{5} \).
60% = 0.60 = \frac{3}{5}
Number Study: 90%

**Equivalent Forms of 90%**
Numbers can look different and still be the same number. In this Number Study we will look at all the different ways 90% may appear. Remember even though these numbers may look different, they are all equal to 90%.

<table>
<thead>
<tr>
<th>Fraction Form</th>
<th>Decimal Form</th>
<th>Percent Form</th>
<th>Verbal Form</th>
</tr>
</thead>
<tbody>
<tr>
<td>Write at least 5 equivalent fraction forms.</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

**Representations of 90%**
Now we will look at different representations of 90%. Keep in mind unlike the numbers above, these pictures may not represent amounts that are the same size. It all depends what you are taking 90% of.

Label 90% on this percent strip and figure out how many inches are in 90%.

<table>
<thead>
<tr>
<th>0%</th>
<th>80%</th>
<th>100%</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 in</td>
<td>24 in</td>
<td></td>
</tr>
</tbody>
</table>

Art earned a 90% on his math quiz which had 60 questions. How many questions did he answer correctly?

Shade in 90% of the octagons.

**90% in the Real World**
Find an example of 90% in the real world. When possible, glue the example to the bottom of this paper; when not, describe where you found 90%.
Encouraging Mathematical Reasoning