Number Talks:
Fractions, Decimals, and Percentages

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Fluency with Fractional Reasoning

Critical foundation for determining success in higher mathematics

Siegler, et al, 2012
National Math Panel, 2008
## Student Misconceptions

<table>
<thead>
<tr>
<th>Expression</th>
<th>Which is larger?</th>
</tr>
</thead>
<tbody>
<tr>
<td>(.05 + .28 + 9 + 1.33)</td>
<td>(.5 \text{ or } .105)</td>
</tr>
<tr>
<td>(2 \frac{1}{2} - \frac{7}{8})</td>
<td>(\frac{2}{7} - \frac{1}{5})</td>
</tr>
<tr>
<td>(\frac{3}{4} ÷ \frac{1}{2})</td>
<td>(\frac{3}{5} + \frac{3}{4})</td>
</tr>
</tbody>
</table>
Standards for Mathematical Practices

- Make sense of problems and persevere
- Reason abstractly and quantitatively
- Construct viable arguments and critique the reasoning of others
- Model with mathematics
- Use appropriate tools strategically
- Attend to precision
- Look for and make use of structure
- Look for an express regularity in repeated reasoning
Number Talks

A five to fifteen minute classroom conversation around purposefully crafted problems that are solved mentally.
Computation Goals

- Accuracy
- Flexibility
- Efficiency
Principles of Number Talks

- Logico-Mathematical Knowledge
- Safe Learning Community
- Purposeful Problems
- Purposeful Recording
3 Types of Knowledge

- Social
- Physical
- Logico-Mathematical
Physical Knowledge

Science
Logico-Mathematical Knowledge

Mental Relationships
How many do you see?

How do you see it?
How many do you see?

How do you see it?
Key to Number Talks

Use accurate language to support mental relationships
Think about how you would solve this problem.

Share your strategy while your partner records your thinking.
Purposeful Recording for $1.5 \times 2.4$

\[
1.5 \times 2.4 = (1 + .5) \times 2.4
\]

\[
= (1 \times 2.4) + (.5 \times 2.4)
\]

\[
= 2.4 + 1.2
\]

\[
= 3.6
\]

Distributive Property
Purposeful Recording for $1.5 \times 2.4$

\[
1.5 \times 2.4 \\
= (1.5 \times 2) \times (2.4 \times 1/2) \\
= 3 \times 1.2 \\
= 3.6
\]

Identity Property
Purposeful Recording for $1.5 \times 2.4$

1.5 $\times$ 2.4

$= 1.5 \times (2 \times 1.2)$

$= (1.5 \times 2) \times 1.2$

$= 3 \times 1.2$

$= 3.6$

**Associative Property**
Principles to Actions

Understanding before Procedures

(NCTM, 2014)
Strategies

Algorithms

Standard Algorithms
Principles of Number Talks

- Logico-Mathematical Knowledge
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6th Grade Number Talk String

1 ÷ 1/3
2 ÷ 1/3
2 ÷ 2/3
Think About. . .

- How does the teacher create a safe learning community?
- How does the Number Talk string support student reasoning?
- Which student strategies surprised you?
- What problem would you pose next? Why?
Investigating Student Strategies

$1 \div \frac{1}{3}$

$2 \div \frac{1}{3}$

$2 \div \frac{2}{3}$

$5 \div \frac{2}{3}$
Developing flexibility among fractions, decimals, and percentages
.75 + 1 3/8

• Think about how you would solve this problem.
• Share your strategy while your partner records your thinking.
\[ .75 + 1 \ 3/8 \]

\[ = .75 + (1 + 1/4 + 1/8) \]

\[ = (.75 + 1/4) + 1 + 1/8 \]

\[ = 1 + 1 + 1/8 \]

\[ = 2 \ 1/8 \]
.75 + 1 3/8

(.75 + .25) + 1 3/8

1 + 1 3/8

2 3/8 – 1/4

= 2 1/8
5th Grade Multiplication String

\[
\frac{1}{2} \times \frac{1}{3} \\
\frac{1}{4} \times \frac{1}{3} \\
\frac{1}{4} \times \frac{2}{3}
\]
Student Responses for $\frac{1}{4} \times \frac{1}{3}$

$\frac{1}{12}$

$\frac{4}{48}$

$\frac{2}{24}$

$8 \ 1/3 \%$
Using an Area Model to Justify

\[
\frac{1}{4} \times \frac{1}{3} = \frac{1}{12}
\]
Using the Identity Property to Justify $\frac{2}{24}$

\[ \frac{1}{12} \times 2 = \frac{2}{24} \]

\[ \frac{2}{2} = 1 \]
Using a Previous Problem, \( \frac{1}{2} \times \frac{1}{3} \)

\[ \frac{1}{6} = 16 \frac{2}{3}\% \]

\[ \frac{1}{12} = 8 \frac{1}{3}\% \]
Using Percents and Reciprocals

4. \( \frac{1}{4} = 25\% \)

25\% ÷ 3 = 8 \( \frac{1}{3} \)%

8 \times 3 = 24

8 \( \frac{1}{3} \) \times 3 = 25
Think About. . .

- What evidence supports the student’s flexibility in thinking?
- When does the teacher ask and when does she tell?
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When you teach a child something you take away forever his chance of discovering it for himself.

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