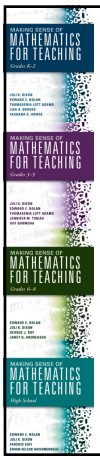
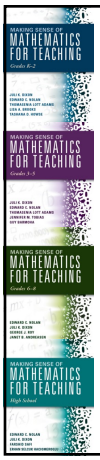


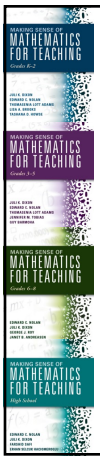
Leading with Mathematics

Juli K. Dixon, Ph.D.
JuliDixonMath@gmail.com

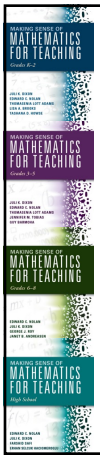
Handout:
http://www.dnamath.com/presentations/



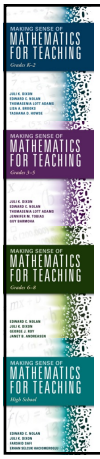
In your leadership role, what are your main responsibilities in supporting mathematics teaching?



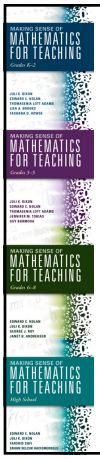
Where do you spend more time, supporting teachers to examine data or to plan for instruction?



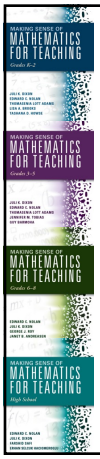
What are teachers' greatest needs when planning for instruction?



A lack of a "deep understanding of the content that [teachers] are expected to teach may inhibit their ability to teach meaningful, effective, and connected lesson sequences, regardless of the materials that they have available" (Leinwand et al., 2014, p. 71).

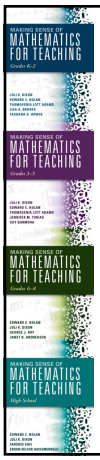


"Instructional leadership is positioned as central to effecting changes in classroom practice, but our study suggests that approaches not informed by [Leadership Content Knowledge] LCK are not likely to affect meaningful changes in practice" (Quebec Fuentes & Jimerson, 2020, p. 26).

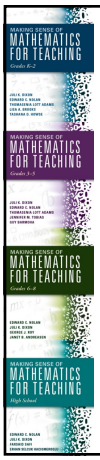


Session Goals

- Examine the current foci in leadership in mathematics.
- Discuss importance of leading with content knowledge for teaching.
- Model the use of "estimation" to lead the development of content knowledge for teaching.



The results from a five-year project focused on developing classroom-based teacher leaders "suggest that developing teachers' expertise in knowledge, instructional practice, and research can provide the foundation for teachers to act and be seen as teacher leaders" (Boston, et. al, 2025, p. 19).

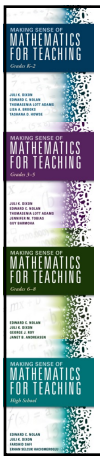


References

Boston, M. D., Dixon, J. K., Bush, S. B., Brooks, L. A., Moore, B. E., Rutledge, T., & Maldonado, A. M. (2025). Positioning K-8 Classroom Teachers as Mathematics Instructional Leaders. Education Sciences, 15(8), 982. https://doi.org/10.3390/educsci15080982

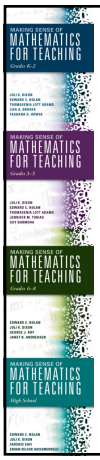
Leinwand, S., Brahier, D. J., Huinker, D., Berry III, R. Q., Dillon, F. L., Larson, M. R., Leiva, M. A., Martin, W. G., & Smith, M. S. (2014). *Principles to actions: Ensuring mathematical success for all*. Reston, VA: National Council of Teachers of Mathematics.

Quebec Fuentes, S. Q., & Jimerson, J. B. (2020). Role enactment and types of feedback: The influence of leadership content knowledge on instructional leadership efforts. *Journal of Educational Supervision, 3*(2), pp. 6-31.



What words come to mind when teachers think about estimation?

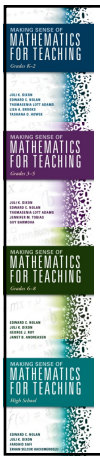
prediction approximation close to rounding around round guess



Session Goals

- Discuss perceptions related to estimation.
- Engage in tasks that are enhanced by estimation.
- Connect estimation to conceptual understanding.

But why?



Very recently –

- ✓ A flight attendant informed us that we would land at "approximately 7:59 pm."
- ✓ My lunch check included choices of tip percentages, the cost of each percent option, and the total cost with the tip included.

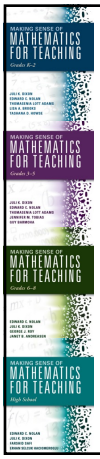
No need to think there…

Even today–

- ✓ The pilot on my flight shared that the flight would be "approximately one hour eleven minutes from take off to landing."
- ✓ My Uber driver from the airport took one look at my luggage and threatened to give me a one-star rating…

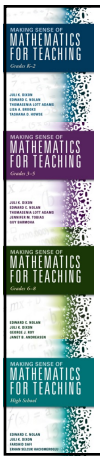
What words come to mind when teachers think about estimation?

prediction
approximation
close to
rounding
around
round
guess



Estimate the following:

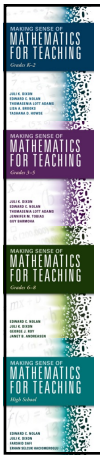
5 x 23



Was your choice included here?

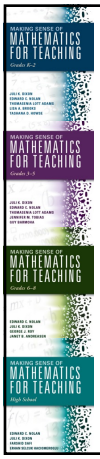
5 x 23

a) 100
b) 115
c) 120
d) 125



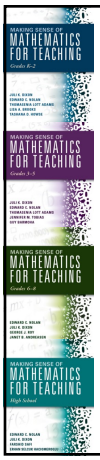
Estimate the following:

157 + 624



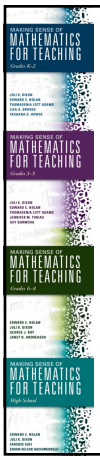
Estimate the following:

624 – 157



With what do we estimate?

- Quantities
- Computation
  - Whole Numbers
  - Decimals
  - Fractions
- Measurement
  - Time
  - Length
  - Area
  - Volume
  - Mass



Estimating Quantities

How many buttons?

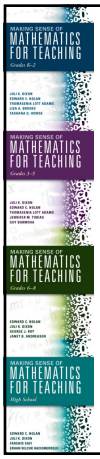
How might we estimate with fractions?

One whole slice of melon.


About how much melon?
© 2026 Juli K. Dixon


About how much melon?
© 2026 Juli K. Dixon

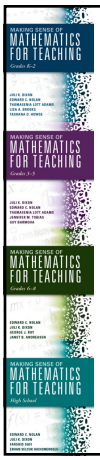

About how much melon?
© 2026 Juli K. Dixon

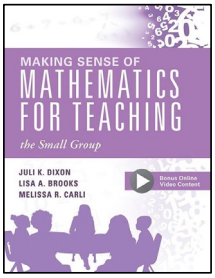


Estimation. What's it "about"?

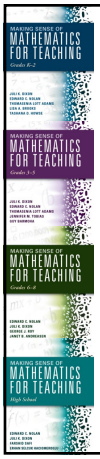
What experiences help students to develop the "fraction sense" needed to estimate?

And how do we help the teachers we support to see the importance of prioritizing them?



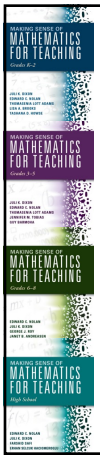


Making Sense of Mathematics for Teaching the Small Group



Discourse Norms

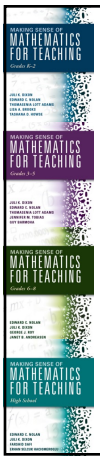
- Provide explanations and justifications with solutions.
- Make sense of others' solutions.
- Communicate when you don't understand or don't agree.



Estimation. What's it "about"?

How do we extend early understandings of fractions?

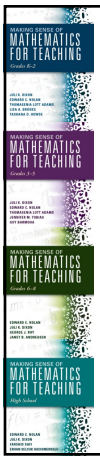
Consider comparing fractions.



Estimation. What's it "about"?

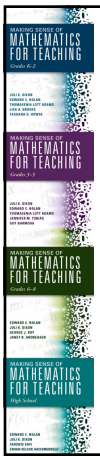
Why do we compare fractions?

We compare fractions to develop an understanding of the magnitude of fractions (if we do it right).



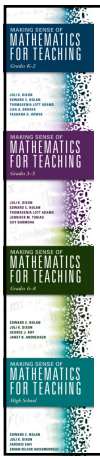
Estimation. What's it "about"?

Compare $\frac{4}{7}$ and $\frac{4}{5}$.

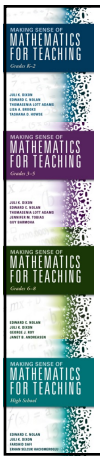


Estimation. What's it "about"?

Compare $\frac{3}{5}$ and $\frac{4}{9}$.

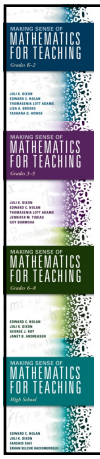


Estimating Computations



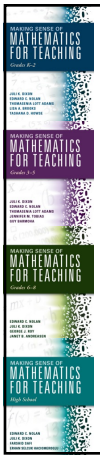
Estimate the following:

$$\frac{1}{2} + \frac{2}{5}$$



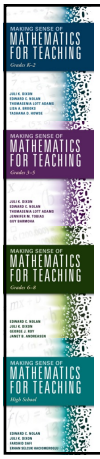
Estimate the following:

$$\frac{2}{7} + \frac{3}{13}$$



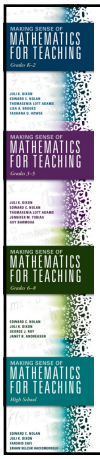
Estimate the following:

$$3\frac{4}{5} + 1\frac{1}{3}$$



Estimate the following:

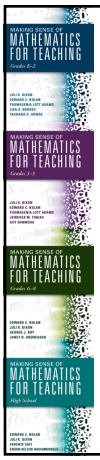
$$1\frac{7}{8} - \frac{1}{2}$$



Estimation. What's it "about"?

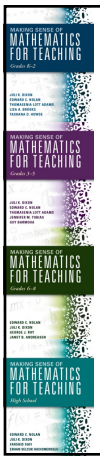
How did that feel?

And how can we make it feel better for the teachers we support?

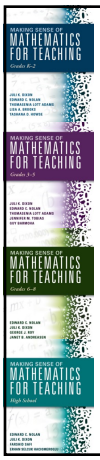


We need to focus on:

- Developing general understandings of fractions.
- Estimating with "nasty" fractions by using "friendly" fractions.
- Connecting whole number operations to operations with fractions through context.

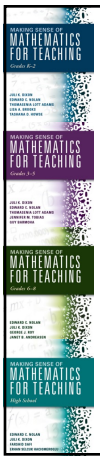


Consider $\frac{3}{5} \times \frac{7}{8}$.

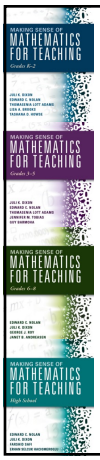


Now consider 3 x 4.

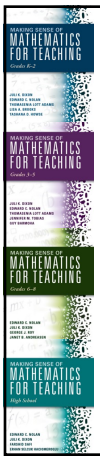
What does it mean?



Now consider $\frac{3}{5}$x 4.

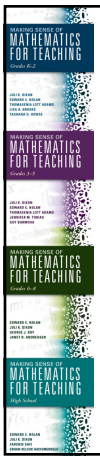


Reconsider $\frac{3}{5}$x $\frac{7}{8}$.



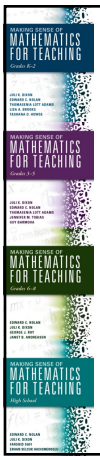
Estimate the following:

$$1\frac{2}{3} \times \frac{3}{5}$$



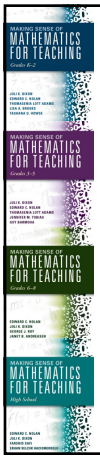
Estimate the following:

$$\frac{7}{8} \times 9$$



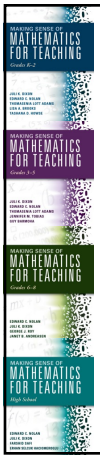
Estimate the following:

$$5\frac{1}{4} \div \frac{8}{9}$$

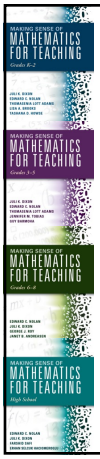


Estimate the following:

$$\frac{5}{6} \div \frac{1}{4}$$

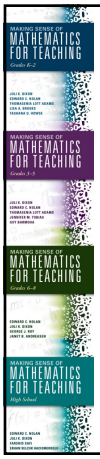


Consider 12 ÷ 4.



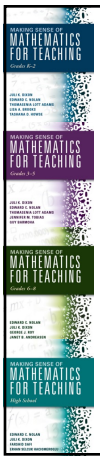
Making Sense of Division Problem Types

Problem Structure	Number of Groups (a)	Number of Objects in Each Group (b)	Total Number of Objects (c)
Multiplication	a	b	?
Sharing Division	a	?	c
Measurement Division	?	b	c



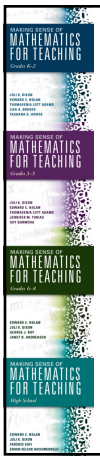
Cultivating Perseverance

- Just-in-case scaffolding
- Just-in-time scaffolding



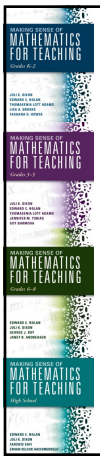
Estimation. What's it "about"?

The problem type AND the quantities matter when making sense of fraction division problems.



Estimate the following:

Consider $\frac{5}{6} \div 4$



Analyze this:

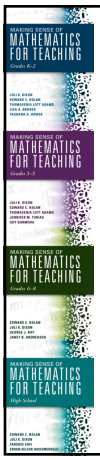
$$1\frac{3}{4} \div \frac{1}{2}$$

a) $\frac{7}{8}$

b) $3\frac{1}{4}$

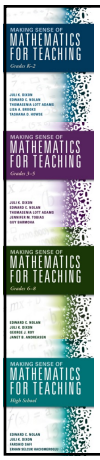
c) $\frac{4}{14}$

d) $3\frac{1}{2}$



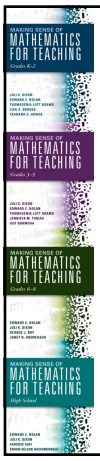
Estimation. What's it "about"?

Estimation provides a more valuable return on the investment of time we spend on multiple choice problems.



With what do we estimate?

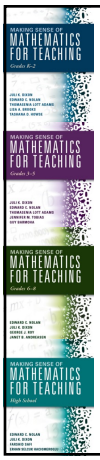
- Quantities
- Computation
  - Whole Numbers
  - Decimals
  - Fractions
- Measurement
  - Time
  - Length
  - Area
  - Volume
  - Mass



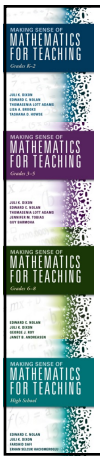
Estimation. What's it "about"?

How does work with estimation support measurement?

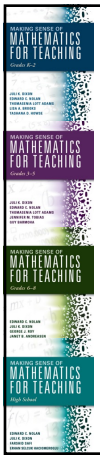
Think about how early experiences with the cookie problem might help students make sense of units of measure.



Estimating Measurements

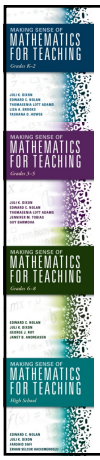


HMH



Estimation. What's it "about"?

Consider these conversion problems.



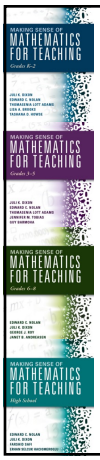
Estimation. What's it "about"?

Do you multiply or divide by 1,000 to solve?

520 mm = _____ m

520 mL = _____ L

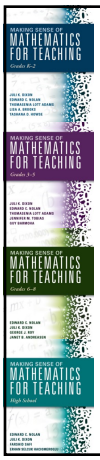
520 km = _____ m



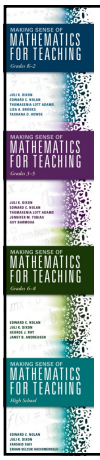
Estimation. What's it "about"?

How does this connect to work with fractions?

Remember the small group video where students looked at the number of pieces in the cookie?



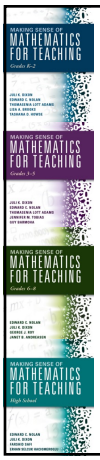
Estimating Computation with Measurement



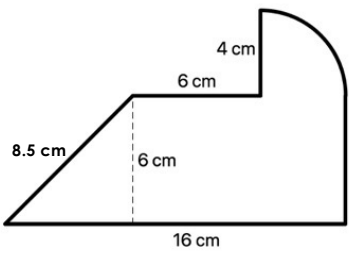
Estimation. What's it "about"?

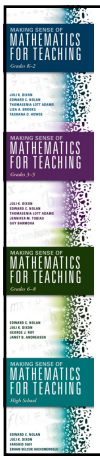
How might estimation help students with problems involving area?

How does this connect to estimating quantities and estimating with calculations?

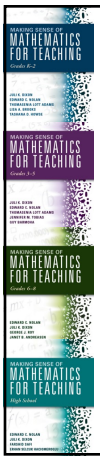


Estimation. What's it "about"?



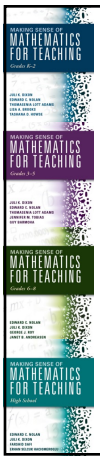


What words come to mind when you think about estimation?



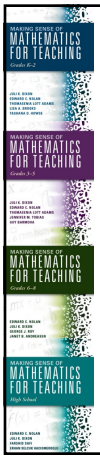
Session Goals

- Discuss perceptions related to estimation.
- Engage in tasks that are enhanced by estimation.
- Connect estimation to conceptual understanding.

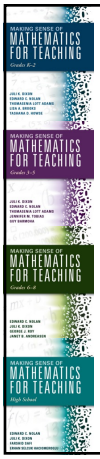


Session Goals

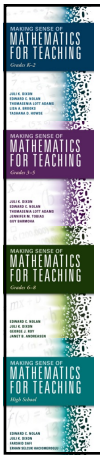
- Examine the current foci in leadership in mathematics.
- Discuss importance of leading with content knowledge for teaching.
- Model the use of "estimation" to lead the development of content knowledge for teaching.



When there is a lack of focus on mathematics knowledge for teaching, teachers are more likely to…



- Neglect linking topics along the vertical progression of content;
- Choose low-level tasks rather than engaging, multifaceted tasks;
- Use gradual release of responsibility rather than facilitating instruction;
- Avoid common errors rather than eliciting them; and
- Scaffold just in case rather than just in time.



The TQE Learning Lab

- **Tasks** connect to learning goals and help identify student errors.
- **Questions** elicit mathematical understandings and common errors.
- **Evidence** drives scaffolding and guides extensions.