NUMERACY COUNTS

October 2016

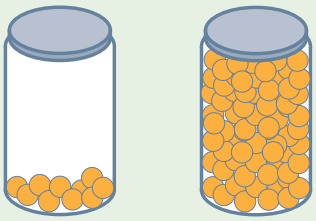
Mental Math Part 3: Computational Estimation

Estimation is a strategy for determining approximate values or quantities. It can also be used for determining the reasonableness of calculated values, to make mathematical judgments, and to develop useful, efficient strategies for dealing with situations in daily life.

Estimation is usually accomplished by referring to **benchmarks**. A benchmark (sometimes referred to as a referent) is something (e.g., a number or quantity, the width of your baby finger, the span of your open hand) that serves as a reference to which something else may be compared.

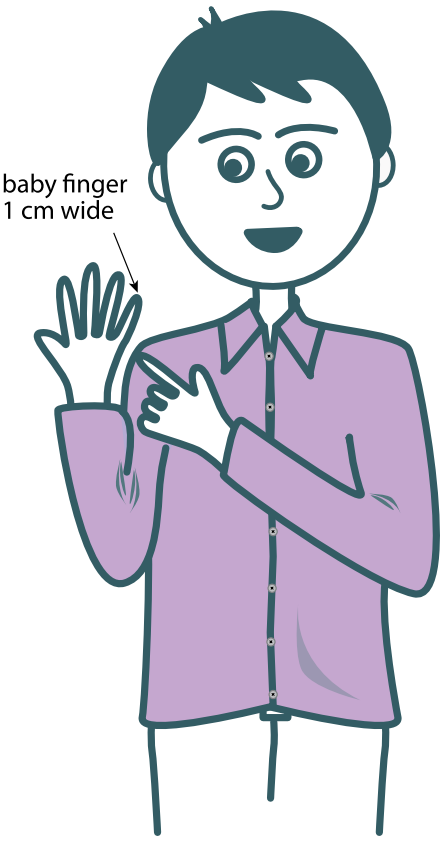
Counting

In this case, counting the candies in the jar is not an efficient method for finding the answer.



Benchmark

By establishing a benchmark of 10 candies in the jar on the left, we can estimate how many are in the full jar. Using a benchmark helps students make a more accurate estimation.



Computational estimation involves arriving at an approximate answer by using strategies that enable the calculations to be done in one's head.

Why is Computational Estimation Important?

High-tech devices have replaced paper and pencil as the major tools for completing complex tasks. As a result, people need to have well-developed mental strategies so they are alert to the reasonableness of the results generated by this technology (and are therefore better able to catch errors when they occur).

Computational Estimation Strategies

General Strategies

- Encourage students to take risks as they explore various computational estimation strategies. They must develop a comfort level in finding approximate answers to computation.
- "Create a classroom environment that encourages student exploration, questioning, verification and sense making" (Reys, p. 5).
- Have the students communicate their thinking as they estimate and then "share their reasoning with the class" (Reys, p. 5).
- Capitalize on class sharing by highlighting the estimation strategies that result in close estimates (e.g., combining compensation with other strategies such as front-end or compatible numbers).

- Provide opportunities for students to explore the multiple relationships among numbers and among operations.
- Provide regular reinforcement so that students always estimate before they calculate to determine the reasonableness of their calculated answers. Van de Walle and Lovin (2006) state, "A good place to begin computation is with estimation. Not only is it a highly practical skill, but it also helps [students] look at answers in ballpark terms and can form a check on calculator computation" (p. 125).
- Provide a variety of problem-solving contexts in which students decide that an estimated answer is adequate and efficient.
- Provide a variety of problem-solving contexts in which students have the opportunity to explore various types of computational estimation strategies and then choose the strategy that works best for them in a given situation. (See the "Estimation Strategies" provided at the Alberta Education website.)

Specific Strategies

- Specific computational estimation strategies are outlined for each grade level in *Kindergarten to Grade 8 Mathematics: Manitoba Curriculum Framework of Outcomes, 2013*.

Estimation Vocabulary

While teaching estimation strategies, it is important to use the language of estimation. Some estimation words and phrases include *about, just about, between, a little more than, a little less than, close, close to, near,* and *approximately.*

Reflection and Discussion

- What learning opportunities and experiences are provided for computational estimation?
- What methods are used to assess student learning related to computational estimation?
- How is student performance related to computational estimation (estimation in general) reflected on the Provincial Report Card in the Mental Math and Estimation category?

Resources

Alberta Education. "Estimation Strategies." *Planning Guide*. Edmonton, AB: Alberta Education, 2008. Available online at www.learnalberta.ca/content/mepg5/html/pg5_estimationstrategies/step1.html

Manitoba Education. *Kindergarten to Grade 8 Mathematics: Manitoba Curriculum Framework of Outcomes, 2013*. Winnipeg, MB: Manitoba Education, 2013. Available online at www.edu.gov.mb.ca/k12/cur/math/framework_k-8/title_isbn.pdf

Ontario Education. *A Guide to Effective Instruction in Mathematics, Kindergarten to Grade 3—Measurement*. Toronto, ON: Queen's Printer for Ontario, 2007. Available online at http://eworkshop.on.ca/edu/resources/guides/Measurement_K-3.pdf

Ontario Education. *Measurement, Grades 4 to 6—A Guide to Effective Instruction in Mathematics, Kindergarten to Grade 6*. Toronto, ON: Queen's Printer for Ontario, 2008. Available online at http://eworkshop.on.ca/edu/resources/guides/Guide_Measurement_456.pdf

Reys, Barbara J. *Developing Number Sense in the Middle Grades*. Reston, VA: National Council of Teachers of Mathematics, 1992.

Small, Marian. *Making Math Meaningful to Canadian Students, K–8*, 2nd Edition. Toronto, ON: Nelson Education Ltd., 2013. Available online at www.nelson.com/pl4u/wp-content/uploads/2014/09/making_math_meaningful_chapter_1.pdf?e1d0f5

Van de Walle, John A., LouAnn H. Lovin, Karen S. Karp, and Jennifer M. Bay-Williams. *Teaching Student-Centered Mathematics, Developmentally Appropriate Instruction for Grades Pre-K–2, 3–5, 6–8*. Toronto, ON: Pearson, 2014.

Van de Walle, John A. and LouAnn H. Lovin. *Teaching Student-Centered Mathematics: Grades 5–8*. Boston, MA: Pearson Education, Inc., 2006.