

Daily Math and Problem Solving

OLE.3

TIME

15 minutes, daily

OVERVIEW

Students practise daily estimation, mental math, and problem solving skills without the use of computational aids. Discussion about strategies used in the computational process is an integral part of mental math, and students are encouraged to use the strategies with which they are most comfortable. They keep a record of their results using a spreadsheet.

Students select a Problem of the Week from the Internet and work as a collaborative group to find a solution to the problem. They create a similar problem, post it on the class website, and give feedback to persons who write to them with a solution.

Students record comments about their estimation, mental-math, and problem-solving experiences in their Math Journals.

LEARNING OUTCOMES

Through this learning experience (LE), students will achieve specific learning outcomes (SLOs) in various subject areas. Consider the intent of this LE and your choice of instructional and assessment strategies to determine which SLOs students may achieve, in addition to those identified.

English Language Arts

Consider the intent of this LE and your choice of instructional and assessment strategies to determine which SLOs students may achieve, in addition to those identified below:

- 1.2.2 *Explain Opinions* — Explain personal viewpoints in clear and meaningful ways and revise previous understanding.

Mathematics

Consider the intent of this LE and your choice of instructional and assessment strategies to determine which SLOs students may achieve, in addition to those identified below:

- N-V.1.6 Estimate the solutions to calculations, and solve problems that involve addition and subtraction operations on decimals to thousandths.
- N-V.2.6 Estimate the solutions to calculations, and solve problems that involve multiplication and division operations on decimals to thousandths (for calculations involving 2-digit whole number multipliers and divisors, the use of appropriate technology is expected).
- N-V.5.6 Use a variety of methods to solve problems with multiple solutions.

ICT LITERACY SKILLS AND COMPETENCIES

Consider the intent of this LE and your choice of instructional and assessment strategies to determine which skills and competencies students may achieve, in addition to those identified below:

- basic operating skills
- communicating electronically
- inquiry using electronic sources
- spreadsheet analysis

- web page authoring
- word processing

SUGGESTED LEARNING RESOURCES

Software

- spreadsheet
- word processor
- web authoring

Internet

- IMYM Links Database: <<http://www.edu.gov.mb.ca/ks4/tech/imym/resources/links.html>>
- Do an Internet search using the terms “math problem solving” or “grade 6 math problem solving.”

Print

- Appendix C: Index of Teaching and Learning Strategies and Tools
- Jones, Grant. *Problem-Solving: What to Do When You Don't Know What to Do*. Barrie, ON: Exclusive Educational Products, 1991.
- ---. *The World's Most Popular Puzzles and Problems: Grades 5 to 9*. Barrie, ON: Exclusive Educational Products, 1996.
- Lipke, Barbara. *Figures, Facts, and Fables: Telling Tales in Science and Math*. Portsmouth, NH: Heinemann, 1996.
- Manitoba Education and Training. *Grades 5 to 8 Mathematics: A Foundation for Implementation*. Winnipeg, MB: Manitoba Education and Training, 1997.

BLMs

- BLM OLE.3#1 Problem-Solving Learning Centre
- BLM OLE.3#2: Problem-of-the-Week Chart

TBLM

- TBLM OLE.3#1: Mental Math and Estimation

SUGGESTIONS FOR INSTRUCTION

MENTAL MATHEMATICS

Mental mathematics is described in *Grades 5 to 8 Mathematics: A Foundation for Implementation* as “the computing of answers without paper or pencil or other computational aids. It is an important process in mathematics because skill at mental computation

- is a practical life skill
- can make other computations easier and quicker
- is essential in estimation
- can lead to a better understanding of place value, mathematical operations, and basic number properties” (Appendix, Teacher Information: Mental Math and Estimation)

The purpose of this OLE is to ensure that students have daily opportunities to practise math skills. Select mental math activities or skills related to the math strand currently being taught in the class or appropriate for the *Inventions, Innovations, and Discoveries* interdisciplinary unit.

Preparation and Set-up

- Become familiar with the computational mental math, estimation, and thinking strategies discussed in *Grades 5 to 8 Mathematics: A Foundation for Implementation*.
- Decide on a daily format and prepare transparencies for overhead presentation or an electronic document for use with a computer and a projection system.
- Become familiar with creating a spreadsheet and using its graphing/charting function.
- Set up bookmarks or favourites of links to suitable mathematics websites found on the IMYM Links Database for students to access throughout the school year, or place the links on the class website.

Activating Strategies

- Explain that mental math usually requires non-traditional computational processes and review the principles of arithmetic. Discuss strategies that students use when they are estimating or using mental math.
- Conduct a mental math card game such as “Who Has My Number?” as described in *Grades 5 to 8 Mathematics: A Foundation for Implementation* (Appendix, Teacher Information: List of Questions for “Who Has My Number?”).

OR

Using a transparency or an electronic document on a computer with a projection system, display a suitable mental math question. Student volunteers suggest some strategies they might use to answer the question.

Acquiring Strategies

- Post another similar mental math question for students to answer on their own.
- Invite students to demonstrate the method they used when solving the question of the day. Discuss the strategies that students demonstrate.

Applying Strategies

- Provide short daily mental math sessions during which students answer the posted questions and discuss, as a class or in collaborative groups, the computing and thinking strategies they use.
- Students record their daily results in a table in their Math Journals or on spreadsheet software and create a monthly graph of their results.
- Students keep a Math Journal of their own responses and observations of their progress in mental math and estimation based on the graphed results, comparing their monthly results as the school year progresses. Students should be able to explain why their average results change when attempting a new strategy.

PROBLEM SOLVING**Preparation and Set-up**

- Become familiar with the computational estimation and thinking strategies discussed in *Grades 5 to 8 Mathematics: A Foundation for Implementation* (Appendix, Teacher Information).
- Access one of the Math Problem Solving websites listed on the IMYM Links Database and find a suitable math problem. It could be related to the current strand being taught in class. Place the link on the class website.

Activating Strategies

- Review problem-solving strategies related to the chosen problem of the week.

- Access a Math Problem Solving website for weekly problem-solving questions. Use these websites for classroom instruction or in a learning centre (see Connection to Learning Centre).

Acquiring Strategies

- In collaborative groups, students attempt to solve the problem of the week.
- Students discuss their proposed solution and record the problem-solving process they followed to achieve it.

Applying Strategies

- In collaborative groups, students write a similar problem and post it in the classroom or on the class website for the class to access and solve. They include a contact email address for replies.
- Other students in the class access the website, attempt to solve the problem, and email their answer and solution.

Variations/Extensions

- Students exchange problems with their key pals.
- Once a week, students take home a problem and involve their families in solving the problem.
- Students post problems on a Grade 6 Math Problem of the Week web page they create on their class website, and take responsibility for answering the emails they receive.

SUGGESTIONS FOR ASSESSMENT

- Note student improvement in accuracy and speed of estimation and mental calculations. Track students' scores on their daily mental math/estimation and problem solving using a spreadsheet. Graph the scores once a month.
- Read student's Math Journals to determine whether they recognized any patterns in their daily mental math scores relating to the mental math/estimation and problem-solving strategies used. Confer with students on their achievements and answer their questions.

CONNECTION TO INVENTIONS, INNOVATIONS, AND DISCOVERIES

- Students create problems using the survey results obtained in Mod.2.5: Tally-Ho, Mod.2.6: Customer Service Department, and Mod.3.5: Awareness of Electrical Energy Consumption of the *Inventions, Innovations, and Discoveries* interdisciplinary unit.

CONNECTION TO LEARNING CENTRE

- Students solve the selected math problem of the week from a Math Problem Solving website and submit their answer by email.
- Use BLM OLE.3#1: Problem-Solving Learning Centre as a guide for students.
- Consider creating other learning centres focusing on approved problem-solving software.

BLM OLE.3#1: Problem-Solving Learning Centre

Overview

Students solve the selected math problem and submit answers in writing to the teacher, to their classmates, or by email to a selected Math Problem Solving website that allows for student input and participation.

Resources

- See the IMYM Links Database for suitable Math Problem Solving websites.

Task

- Access the selected problem from a Math Problem Solving website.
AND/OR
Check the class website for student-posted problems to solve or access email for problems sent by key pals.
- Discuss the selected problem with group members and record the solution.
- Use BLM OLE.3#2: Problem-of-the-Week Chart to record the group's answer and describe how the group solved the problem.

Collaborative Goal

- Group members decide who works at the keyboard and who records the problem and solution.

What to Do with the Results of This Learning Centre

- File the BLM OLE.3#2: Problem-of-the-Week Chart in the Personal OLE Binder.

BLM OLE.3#2: Problem-of-the-Week Chart

Name _____ Date _____

Group Members _____

Summary of the Problem	
Group's Answer	
Computational Strategies Used to Solve the Problem	Correct Answer (If Different from the Above)

TBLM OLE.3#1: Mental Math and Estimation

Discuss the following strategies with students, giving them a chance to share strategies that they use for mental math, estimation, and problem solving.

Compensation or Balancing Strategy

This strategy is based on the fact that it is easy to subtract a multiple of ten from another number.

Example:

- For $160 - 59$, change 59 to 60, think $160 - 60 = 100$, and then adjust or compensate by adding the 1 to make up for the extra 1 subtracted = 101.

Dropping and Reattaching of Common Zeros

This strategy is useful when computing with numbers sharing common trailing zeros.

Examples:

- For the subtraction equation $6000 - 300$, temporarily drop the two common zeros and focus on the front-end digits: $60 - 3 = 57$. Reattach the two zeros to get back the correct place value: 5700.
- For the division equation $600 \div 50$, drop or cancel the common zero—this is the same as dividing both numbers by 10. Focus on the front-end digits: $60 \div 5 = 12$.

Rounding

Change values to make them easier to compute. Several different rounding procedures can be used for a single question.

Example:

- 95×43 can be rounded to 90×40 , 100×40 , or 100×43 .

Consider these common rules:

- If the last digit is 5 or greater, the number is rounded up.
- If the last digit is less than 5, the number is rounded down.

The way numbers are rounded often depends on custom and who is doing the rounding.

Examples:

- Your Mom's birthday may be next month, but when someone asks her age, she will seldom round up.
- When a grocery store sells 3 cans of food at \$1.00, the price for 1 can is $33 \frac{1}{3}\text{¢}$. That number should be rounded down, but stores almost always charge the customer 34¢ .

Identifying Compatibles

This strategy is similar to rounding. The focus in this strategy is on searching for pairs of numbers that are easy to compute.

Example:

- In the question $2270 \div 6$, rounding the dividend to 2300 (the nearest hundred) or 2000 (the nearest thousand) does not help much. Rounding it to 2400 (a compatible number because it is divisible by 6) helps tremendously.

(continued)

Clustering

This strategy is useful when adding a group of numbers that cluster around a common value. To obtain an estimate, select a reasonable average for the group of numbers, and then multiply that average by the number of values in the group.

Example:

$$\begin{array}{r} \$3.42 \\ 2.21 \\ 3.89 \\ 2.97 \\ 3.64 \\ \hline +2.50 \end{array}$$

- In this example, the values cluster around \$3. Since there are 6 of them, the estimate is $6 \times \$3 = \18 .

Front-End Estimating

Identify the most significant digits in a question, perform the appropriate operation, and then determine the place value of the result. This process is most appropriate for addition, subtraction, and division, and has an advantage over rounding in that all the numbers operated on are visible in the original question.

Examples:

$$\begin{array}{r} 4219 \\ 7512 \\ \hline + 2446 \end{array} \qquad \begin{array}{r} 3168 \\ 449 \\ \hline + 2903 \end{array}$$

- In the first example, the total of the front-end digits is 13 (i.e., $4 + 7 + 2$) and the place value is thousands. Therefore, a front-end estimate is 13 000.
- In the second example, the initial estimate using front-end digits is 5000. The adjacent place value could be examined and the initial estimate would be adjusted upward, resulting in an estimate of 6000.

Adjusting

This strategy is often applied to refine an original estimate that was obtained with another strategy. When using the front-end strategy, the estimates appear to be low after one looks at the leftover digits. On the examples shown for the front-end strategy, 1000 could be added to the estimated sums to obtain a more reasonable estimate. This results in estimates of 14 000 and 6400.

Mental Math and Estimation: Adapted, by permission, from Reys, Robert E. "Mental Computation and Estimation: Past, Present, and Future." *The Elementary School Journal* 84.5 (May 1984): 547-57. Copyright © 1984 by The University of Chicago Press.

Reference:

Manitoba Education and Training. *Grades 5 to 8 Mathematics: A Foundation for Implementation*. Winnipeg, MB: Manitoba Education and Training, 1997. (Appendix, Teacher Information: Mental Math and Estimation, n. pag.)