

Grade Band: 3-5

Lesson Length: Approximately 2 days

NCTM Standard and Expectation

Number and Operations

1. Compute fluently and make reasonable estimates.

Learning Objectives

1. The student will identify appropriate uses for estimation.
2. The student will round purchase prices to estimate total purchases in a school store setting.
3. The student will practice estimating by using rounding and mental computations to arrive at estimates.

Connection to Bloom's Taxonomy

- ✓ Comprehension
- ✓ Application
- ✓ Analysis
- ✓ Synthesis

RG's Literary Connection



Great Estimations by Bruce Goldstone is a fun book that teaches children to make intelligent estimations of grouped items. Children are encouraged to not count individual items on a page, but to estimate the items by grouping and clump counting. Estimation skills increase with practice and this book provides page after page of colored photos of grouped items such as bugs, candy, animals or people in a swimming pool. Goldstone has written several educational books and is well known for writing math word problems. In fact, he estimates that he has written more than 30,000 word problems, more than 12,000 pages in different textbooks, and over 2,000,000 individual words!

Word Origin by Hannie



Estimation is from the Latin word *aestimationem* which means "a valuation", and from the word *aestimare* which means "to value." Used as a noun, estimation can be a document or a calculation that provides an approximate value of something such as an item like a car or house. It tells you how much something is worth or how much it cost.

The damage to the car is estimated at five hundred dollars.

I estimate the jar of jelly beans to weigh about 3 pounds.

It can also be used to judge character or provide opinion.

It is my estimation that our football team will win the championship this year.

In my estimation the class will do well on the math test.

Vocabulary Words



1. Estimate – to give an approximate calculation.
2. Round – to give a close approximation of a number, a form of estimating.

Learning Model Component

- ✓ Making Connections
- ✓ Exploring and Learning
- ✓ Extended Learning and Practice
- ✓ Assessment
- ✓ Closure

Teaching Strategies

- ✓ Brainstorming
- ✓ Guided Practice
- ✓ Paired Learning

Materials List

- ✓ Hardcopy and/or on-line dictionary
- ✓ Clear jar or container
- ✓ Happy Cap Erasers or any other small sized school store item appropriate for estimating quantity
- ✓ Calculator
- ✓ Pencils
- ✓ Estimating Store Purchases – Guided Practice
- ✓ Estimate Store Purchases Worksheet
- ✓ Estimate Store Purchases Worksheet Key
- ✓ Geddes Kit List
- ✓ Assessment of Student Progress
- ✓ Crayons or colored pencils
- ✓ Index Cards
- ✓ Item cards created from Geddes Kit List
- ✓ Dice

Estimating School Store Purchases

Making Connections

What is an estimate? Ask several students to use a dictionary or on-line dictionary to define the word “estimate.” Record several of those definitions on the board. In general, an estimate is an approximate calculation. Use *Word Origin by Hannie* for additional clarification.

Ask students to think about times when they may use estimating outside of the classroom. Have students brainstorm responses to the following two questions:

1. When do you make estimates?
2. When do think your parents, teachers, or other adults use estimation?

Some possible responses may include:

To determine:

- how long it will take to drive somewhere unfamiliar
- how long it will take to complete a homework assignment
- how much time will be needed to complete a project at work or home
- how much money to bring to the grocery store to purchase a week’s worth of food
- what time to set the alarm clock based on how long it will take to get ready in the morning
- how many suitcases to pack for a week-long family vacation
- how much gasoline will be needed to fill the car gas tank
- a weekly or monthly budget for household expenses
- how much food to prepare for a party

Discuss why estimation is useful and explain to students the overall purpose of estimation. Students should understand that estimates provide approximations or reasonable answers to questions. Although the exact amount or number might not be known, an estimate helps to plan and prepare. Estimates actually help people to solve problems. The world around us is filled with unknowns. We do not and will not always know or have the exact answer to a question or problem. However, estimates provide people with a way of making reasonable, intelligent approximations when the exact answer is not easily or readily available.

Exploring and Learning

1. Fill a jar with *Happy Cap Erasers* or any other small-sized school store item. Show a single item to students so that they have an idea as to the item's shape and size. Then show the class the filled jar of erasers and ask them to estimate the number of erasers or items in the jar. Record student estimations on the board.
2. As a class, look at the list of estimates and determine if there was a wide range of estimates or were the numbers fairly close to one another.
3. Discuss how estimates are derived by asking students to share their approaches, thought processes, and methods for developing their estimates. Often estimates are developed based on prior knowledge, rough calculations, or simply an educated guess.
4. Explain that estimating is very useful when making purchases. It is a helpful way to calculate quickly the total amount to be purchased and to ensure you have enough money for your purchases.
5. Use Estimating Store Purchases - Guided Practice as a transparency to help guide students through the process of estimation. Explain to students that making estimates in a store may involve rounding, mental calculations, or using paper and pencil to do quick calculations. It is often better to estimate a little higher to ensure that you have enough money to afford the purchase.
6. Present students with the following scenario:



RG and Hannie are purchasing for their Raymond Geddes Elementary School Store. Today in math class, they learned about estimation and want to practice what they have learned for the school store. RG and Hannie will help estimate the total price of two different purchases. With this information, the students will know

whether or not they have enough money to buy what they want to sell at the school store. Sniffer will tabulate the exact total price using a calculator. Can you help RG, Hannie, and Sniffer estimate the students' purchases?

7. To help complete the scenario pair students together and provide them with a copy of Estimate Store Purchases Worksheet. Explain and list on the board or as a transparency the following instructions:
 - Use rounding to generate an estimate for each item.
 - Use a calculator to determine the actual total price.
 - Does each student have enough money to make his/her purchases?
8. As a class, review the results and determine if Natalie and Matt have enough money to make their purchases? Student estimations should determine that Natalie does not have enough money to purchase all the items that she wanted to buy. Review with students Natalie's 2 alternatives found on the Estimate Store Purchases Worksheet Key.
9. The scenario involving Matt provides a different look at estimation. Some students will overestimate Matt's total purchase price when rounding upward. Estimating by rounding upward showed that Matt could not afford all his items. However the actual price for all of his items was less than the \$75.00 he had to spend. Rounding each item's price upward yielded an overestimate. Review the upward estimation on the Estimate Store Purchases Worksheet with students. Explain that when you are making purchases, it is often better to overestimate than to underestimate the total purchase price.
10. Provide students with additional practice at estimating purchase totals by creating item cards using index cards and the Geddes Kit List. You can create up to 20 item cards, each containing the item name and corresponding purchase price. For example, one card will state "Retro Pencil \$8.64/Display". Fold the cards in half and place them in a container.
11. Call two students to the front of the classroom to lead the activity. One student will roll a die and the other will draw an item card from the container. Divide the remainder of the class into teams of 3-4 students. All students will participate by estimating (using mental computation only) a total purchase price within their assigned teams. Remind students that you do not want the *actual* total price, but an *estimate*. To estimate in this activity means to round the item price first and then to multiply that price by the quantity rolled on the die.

12. Ask each team to jot down their estimate. Students will share their estimates aloud after each card is drawn and die rolled. Did everyone arrive at the same estimate? If not, discuss any differences in creating the estimate.

Extended Learning and Practice

1. Open up your own school store using the Geddes School Store Kit and a copy of the *School Store: An Operating Manual*. Operating a school store is an excellent opportunity for inquiry based/hands-on learning that is both fun and rewarding. Create an instant real life business in your classroom by using the merchandise in the Geddes Kit and following the school store operations manual. A school store will allow opportunity for raising money, provides a service to students, and creates an atmosphere of responsibility while building valuable team working skills. This lesson demonstrated how customers use estimation prior to making purchases. Identify several other ways estimation can be used within a school store. Some possibilities include: estimating and forecasting future sales based on prior actual sales data, estimating the amount of shelf space needed to display store items, or simply estimating how much help will be needed to operate the store.
2. Challenge students by using two dice to perform mental computations for each item card created in step 10 of the Exploring and Learning component. Explain to students that estimation is very helpful when the quantities increase and you can begin to group by tens.
3. Have students think about what it means to overestimate versus underestimate. Ask which do you think is better, and why. Provide one or two examples to support your answer.
4. Visit <http://www.ed.gov/pubs/parents/Math/grocerymath.html> (U.S. Department of Education Archives) for additional estimation activities that can be completed at the grocery store.
5. Visit Figure This! Math Challenges for Families at http://www.figurethis.org/challenges/challenge_index.htm. The Challenge Index contains estimation challenges. This website was developed by the National Council of Teachers of Mathematics.

Assessment

The lesson objectives can be assessed by evaluating Estimate Store Purchases Worksheet with Estimate Store Purchases Worksheet- Key. Use the Assessment of Student Progress to assess students' overall abilities to meet the lessons learning objectives which include rounding purchase prices, estimating individual item totals, and estimating overall purchase amounts.

Closure

Provide each student with an index card and have them answer the following questions on one side of the index card:

1. Describe two new things that you have learned.
2. What else would you like to learn about this topic?

On the back side of the index card, instruct the students to draw a picture of something they learned about during this lesson. The index cards can be hole punched and held together with a simple shower curtain ring.

Estimating School Store Purchases Guided Practice

Purchasing one item:

Mary wants to purchase 4 displays of Astral Wonders Pencils. Each display of pencils has a purchase price of \$8.64. Quickly determine an estimate of the total price Mary should expect to pay. Compare this to the actual total price.

- Round the price of \$8.64 to \$9.00.
- Now multiply \$9.00 per eraser by the total quantity of 4.
- Mary's total purchase will be approximately \$36.00.
- The actual price is \$34.56 - only \$1.44 less than the estimate.

Purchasing two items:

Michael wants to purchase 3 bags of Dessert Erasers at \$2.64 each and 2 displays of Bracelet Pens at \$6.96. What is a reasonable estimate for the total price of the items?

- Round the Dessert Eraser price of \$2.64 to \$3.00.
- Round the Bracelet Pen price of \$6.96 to \$7.00.
- Now multiply \$3.00 by the eraser quantity of 3, and \$7.00 by the pen quantity of 2.
- Michael's total purchase will be approximately \$23.00.
- The actual price is \$21.84 – only \$1.16 less than the estimate.

Purchasing three items:

Jean would like to buy 2 tubs of Munchin Mike Sharpeners at \$8.88, 4 Retro Pencils at \$8.64 per display, and 2 Mini Fish Erasers at \$4.44 per bag. What is an estimate for the total purchase price? How much higher or lower is the actual price than the estimate?

- Round the sharpener price of \$8.88 to \$9.00. Multiple \$9.00 by the quantity of 2 for a total sharpener estimate of \$18.00.
- Round the pencil price of \$8.64 to \$9.00. Multiply \$9.00 by the quantity of 4 for a total pencil estimate of \$36.00.
- Round the eraser price of \$4.44 to \$5.00. Multiply by the quantity of 2 for a total eraser estimate of \$10.00.
- Add the three individual estimates for a total estimate of \$64.00.
- Jean's total purchase will be approximately \$64.00.
- The actual price is \$61.20 – only \$2.80 less than the estimate.



Estimating School Store Purchases Worksheet

Help RG and Hannie estimate total purchases to stock merchandise at the Raymond Geddes School Store.

- 1. Natalie has \$50.00 to spend on merchandise for the school store. She would like to buy the following items: 4 Pet Silhouettes Pencils (\$8.64/display) and 2 Piranha Sharpeners (\$8.88/display).**

- Round each item's purchase price to generate an estimate.

Estimated price of 4 Pet Silhouettes Pencils \$ _____
Estimated price of 2 Piranha Sharpeners \$ _____

Total Estimate \$ _____

- Based on the total estimate, do you think Natalie will have enough money to buy all the items?

Yes _____ No _____

- Use a calculator to determine the actual prices.

Actual price of 4 Pet Silhouettes Pencils \$ _____
Actual price of 2 Piranha Sharpeners \$ _____

Total Actual Price\$ _____

- Based on the total actual price, does Natalie have enough money to buy all the items?

Yes _____ No _____

- If she does not have enough money, what can she buy with her money? Explain and show your work.



Estimating School Store Purchases Worksheet

2. Matt has \$75.00 to spend on merchandise for the school store. He would like to buy the following items: 5 Erasing Grips (\$9.00/bag), 4 Dessert Erasers (\$2.64/bag), and 3 6-Color Pens (\$6.48/display).

- Round each item's purchase price to generate an estimate.

Estimated price of 5 Erasing Grips \$ _____
 Estimated price of 4 Dessert Erasers \$ _____
 Estimated price of 3 6-Color Pens \$ _____

Total Estimate \$ _____

- Based on the total estimate, do you think Matt will have enough money to buy all the items?

Yes _____ No _____

- Use a calculator to determine the actual prices.

Actual price of 5 Erasing Grips \$ _____
 Actual price of 4 Dessert Erasers \$ _____
 Actual price of 3 6-Color Pens \$ _____

Total Actual Price\$ _____

- Based on the total actual price, does Matt have enough money to buy all the items?

Yes _____ No _____

- If he does not have enough money, what can he buy with his money? Explain and show your work.

Estimating School Store Purchases

Worksheet - Key

Help RG and Hannie estimate total purchases to stock merchandise at the Raymond Geddes School Store.

1. Natalie has \$50.00 to spend on merchandise for the school store. She would like to buy the following items: 4 Pet Silhouettes Pencils (\$8.64/display) and 2 Piranha Sharpeners (\$8.88/display).

- Round each item's purchase price to generate an estimate.

Estimated price of 4 Pet Silhouettes Pencils	\$36.00
Estimated price of 2 Piranha Sharpeners	\$20.00

Total Estimate	\$56.00

- Based on the total estimate, do you think Natalie will have enough money to buy all the items?

Yes ____ No X

- Use a calculator to determine the actual prices.

Actual price of 4 Pet Silhouettes Pencils	\$34.56
Actual price of 2 Piranha Sharpeners	\$17.76

Total Actual Price	\$52.32

- Based on the total actual price, does Natalie have enough money to buy all the items?

Yes ____ No X

- If she does not have enough money, what can she buy with her money? Explain and show your work.

Alternative 1 - She can purchase 4 Pet Silhouettes Pencils and 1 Piranha Sharpener for a total price of \$43.44.

$$(4 \times \$8.64) + (1 \times \$8.88) = \$43.44$$

Estimating School Store Purchases Worksheet - Key

Alternative 2 – She can purchase 3 Pet Silhouettes Pencils and 2 Piranha Sharpeners for a total price of \$43.68.

$$(3 \times \$8.64) + (2 \times \$8.88) = \$43.68$$

2. Matt has \$75.00 to spend on merchandise for the school store. He would like to buy the following items: 5 Erasing Grips (\$9.00/bag), 4 Dessert Erasers (\$2.64/bag), and 3 6-Color Pens (\$6.48/bag).

- Round each item's purchase price to generate an estimate.

Estimated price of 5 Erasing Grips	\$45.00
Estimated price of 4 Dessert Erasers	\$12.00
Estimated price of 3 6-Color Pens	\$21.00

Total Estimate	\$78.00

- Based on the total estimate, do you think Matt will have enough money to buy all the items?

Yes ____ No X

- Use a calculator to determine the actual prices.

Actual price of 5 Erasing Grips	\$45.00
Actual price of 4 Dessert Erasers	\$10.56
Actual price of 3 6-Color Pens	\$19.44

Total Actual Price	\$75.00

- Based on the total actual price, does Matt have enough money to buy all the items?

Yes X No ____

- If he does not have enough money, what can he buy with his money? Explain and show your work.

Geddes Kit List

	Item Name	RG Item #	Purchase Price
1	Retro Pencils	67176	8.64
2	Pet Silhouettes Pencils	67175	8.64
3	Astral Wonders Pencils	67124	8.64
4	Munchin Mike Sharpener	67183	8.88
5	Piranha Sharpener	67037	8.88
6	Mouse Sharpener	65627	8.88
7	Erasing Grip	67137	9.00
8	Criss Cross Critters	67036	10.00
9	Happy Cap Erasers	64259	3.00
10	Dessert Erasers	66993	2.64
11	Twister Erasers	67027	3.00
12	Mini Fish Erasers	67099	4.44
13	G Mechanical Pencils	67039	3.00
14	Traction Mechanical Pencils	67013	3.00
15	Cushion Click Mechanical Pencils	66315	6.00
16	.7mm Value Lead	61152	7.20
17	Study Buddy Inferno	66967	8.88
18	6-Color Pens	66685	6.48
19	Bracelet Pens	65581	6.96
20	Twister Pens	66921	6.25

Use the following summary to assess a student's abilities and performance throughout the lesson. Share this assessment with students at the start of the lesson so that students will understand how they will be assessed prior to beginning the Exploring and Learning section. The tool can be used as a basis for providing feedback to the student. Use the scale below to score each of the following items:

Making Connections:

_____ Student participates in discussion by offering answers to one or more of the questions asked by the teacher.

Exploring and Learning

_____ Student estimates the number of erasers or items in the jar.

_____ Student participates in discussion by sharing approach for developing the estimate.

_____ Student works with partner rounding purchase prices to estimate total purchases in a school store setting.

_____ Student compares estimates against actual totals to determine if they can afford the items they would like to purchase.

_____ Student practices estimating by using rounding and mental computations to arrive at estimates in step 11 of the Exploring and Learning component.

SCALE

4 – Excellent

Student completes the activity, task or assignment with no errors and demonstrates mastery of concepts and/or lesson objectives.

3 – Good

Student completes the activity, task, or assignment with few major errors and demonstrates an understanding of the concepts and/or lesson objectives.

2 – Fair

Student completes the activity, task, or assignment with some major errors and demonstrates difficulty with the concepts and lesson objectives.

1 – Poor

Student does not complete the activity, task, or assignment and demonstrates no understanding of the concepts and/or lesson objectives.