WORKING WITH THE

100-BEAD
REKENREK

Activities for Place Value and Operations

BY DON S. BALKA

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* Used in more than one activity

Introduction

Many manipulatives, such as Unifix Cubes and base-ten blocks, are available for teaching early number concepts. Since the appearance of the Rekenrek in the United States in recent years, teachers have found this manipulative to be valuable for students as they learn essential number ideas. Resembling an abacus, the simplest Rekenrek consists of two rows of 10 beads, with five red beads and five white beads in each row.

The author's earlier book *Working with the Rekenrek* (Didax, 2016) provides many activities for this particular manipulative. The 100-Bead Rekenrek has 10 rows of 10 beads, with the first five rows having five red beads to the left of five white beads. The last five rows reverse the color scheme, having five white beads to the left of five red beads. Rekenreks are also available with all ten rows having five red beads to the left of five white beads. The activities in this book will work with either style of Rekenrek.

The Rekenrek, or counting rack, was developed at the Freudenthal Institute in the Netherlands by Adrian Treffers. Having students focus their learning on groups of five or groups of 10 up to 100 provides an anchor for place-value and operation ideas.

Current Mathematics Standards and the Rekenrek

The Rekenrek activities and games in this book focus on three domains or strands in the Grades 1–3 mathematics curriculum: **Counting, Numbers and Operations in Base Ten,** and **Operations and Algebraic Thinking.** For each activity in the book, the relevant standard is shown on the teacher page.

Counting

With the 100-Bead Rekenrek, counting is extended to 100. The frame provides opportunities for students in Grades 1 and 2 to easily count by tens and to visualize the process. Likewise, activities in the book engage students in moving groups of 5 red-and-white colored beads as they count by fives to 100, an extension of their activities in counting by fives using the two-row Rekenrek. Now, students can focus on the idea of multiples of 5 or 10.

Place Value

The two-row Rekenrek allows students to make groups of 10 (1 + 9, 2 + 8, . . .) or groups of 20 (1 + 19, 2 + 18, . . .). With the 100-Bead Rekenrek, students can extend grouping to larger numbers and visualize the result. A number such as 58 means "5 groups of ten and 8 ones."

On the 100-Bead Rekenrek, five rows of 10 beads and one row of 8 beads are moved to the left.
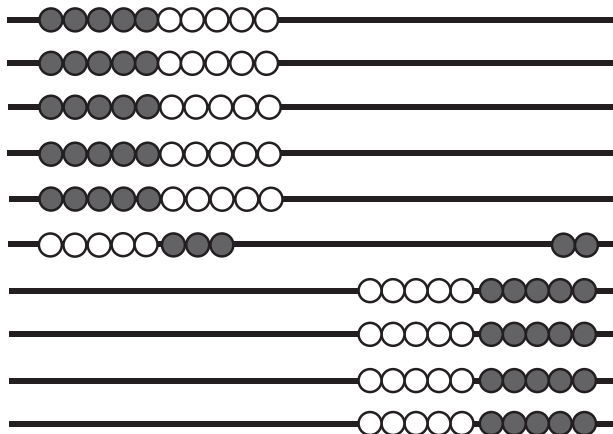
Activities that ask students to compare two-digit numbers and write corresponding number sentences using appropriate symbols (<, >, =) aid their understanding of place-value concepts.

Even and Odd Numbers

Moving beads on the Rekenrek also aids students' understanding of even and odd numbers. The number 47, for example, can first be shown as 4 rows of 10 beads and one row of 7 beads. The row of 7 beads can be shown as 6 beads plus 1 bead. Therefore, 47 is an odd number. The number 54 can first be shown as 5 rows of 10 beads and one

row of 4 beads. Since 4 is even, the number 54 is even. Students learn that an odd number will have one row of beads that can be represented by an even number (0, 2, 4, 6, 8) plus one additional bead.

Addition and Subtraction

Addition and subtraction were introduced in Kindergarten and Grade 1 using the ideas of composition and decomposition. With the 100-Bead Rekenrek, addition and subtraction are extended to larger numbers. A variety of activities focus on the two operations. For example, the number 21 is 1 more than 20 (20 + 1 = 21); 31 is 1 more than 30 (30 + 1 = 31), and so on. For subtraction, the number 19 is 1 less than 20 (19 = 20 − 1); 49 is 1 less than 50 (49 = 50 − 1), and so on.

Addition and subtraction involving multiples of 10 can easily be visualized by students (50 = 10 + 40 = 20 + 30 = 30 + 20 = 40 + 10). With this simple activity, the commutative property for addition of whole numbers can be introduced in Grade 2 or reintroduced from Grade 1. Subtraction of multiples of 10 follows the same subtraction patterns that are used with single digits (for example, 50 − 20 = 30; 5 − 2 = 3). Addition and subtraction of other larger two-digit numbers can be accomplished by students on their Rekenreks.

Multiplication and Division

These operations are typically introduced in Grades 2 and 3. Multiplication is introduced as repeated addition and division is introduced as repeated subtraction. With the 100-Bead Rekenrek, students engage in activities that lead to understanding of the operations, from basic multiplication and division facts to other products and quotients within 100.

Understanding that $a \times b$ means "a groups of b" allows students to move collections of beads to find a specific product. The collections of 5 red beads and 5 white beads provide a good starting place for finding products. The multiplication problem 3 × 5 means "3 groups of 5." Repeated addition is easily shown: 5 + 5 + 5. Students move

3 groups of 5 to the left on their Rekenreks to find the product 15. The multiplication problem 4 × 7 means "4 groups of 7." Students move 4 groups of 7 beads on their Rekenreks to find the product 28.

With division as the inverse operation of multiplication, the Rekenrek provides a good model to show the operation as repeated subtraction. The division problem "$a \div b$" is asking how many groups of b are in a. Just as in multiplication, division by 5 is easily shown on the Rekenrek because of the groups of 5 red and 5 white beads. In the example 40 ÷ 5, students first show 40 on their Rekenreks by moving 4 rows of beads to the left. Now, division as repeated subtraction takes place as students move groups of 5 beads to the right and count the number of groups moved.

As students become proficient with multiplication and division up to 100, various number sentences with unknowns can be introduced. Examples include 6 × ? = 30, ? × 7 = 21, 4 = 12 ÷ ?, and 5 = ? × 9.

Summary

The activities and games in *Working with the 100-Bead Rekenrek* assist teachers as they work with students in Grades 1 through 3 to develop a better understanding of our base-ten number system. Engagement with the 100-Bead Rekenrek provides ready opportunities for students to make relationships among numbers from 1 to 100.

—Don S. Balka

4: Make 100

Number of Students

Entire class

Overview

Students use their Rekenreks to determine what number (addend) will make 100 using a stated number.

Standard

Add within 100, including adding a two-digit number and a one-digit number, and adding a two-digit number and a multiple of 10.
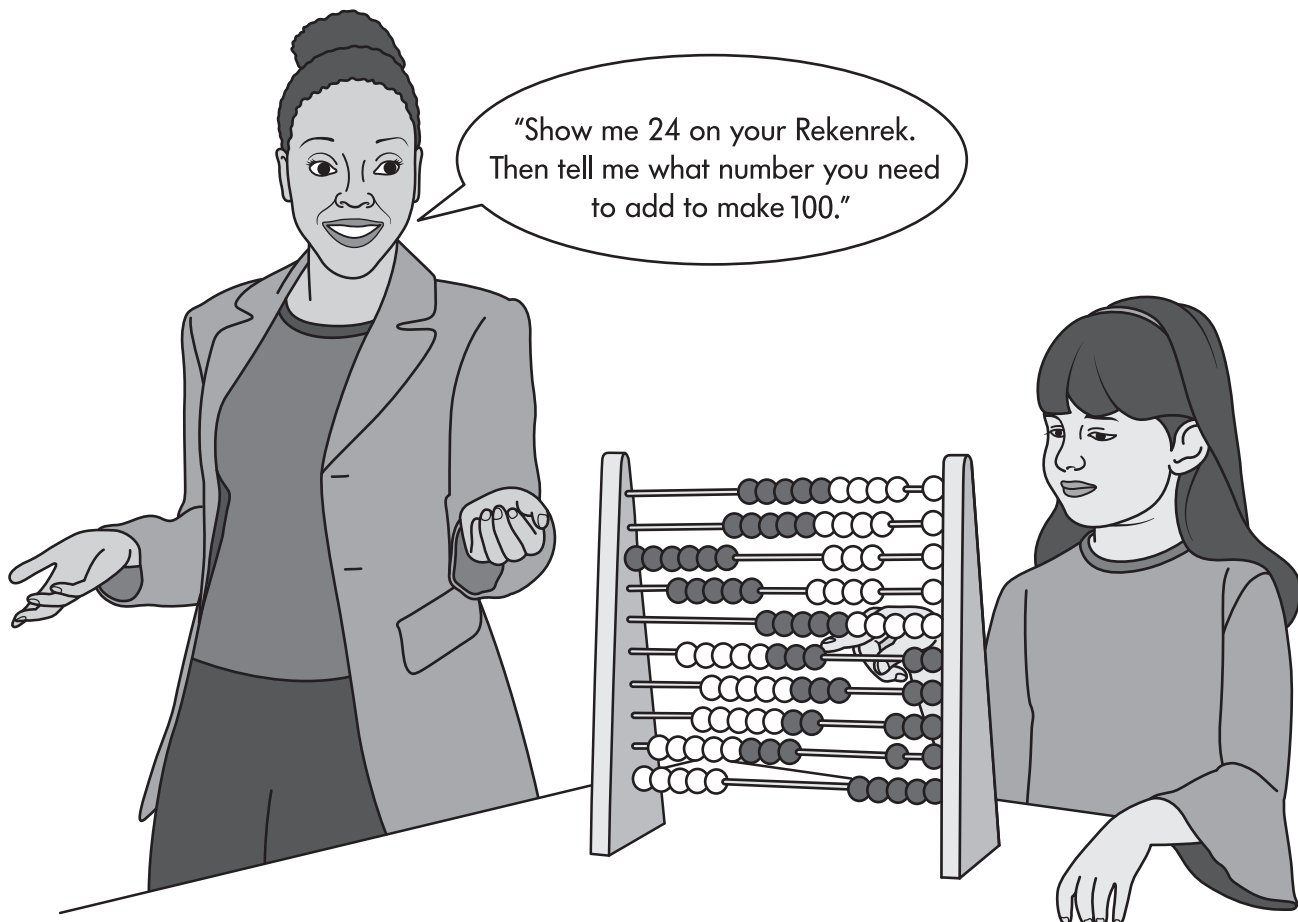
Materials

For each student:

• Student 100-Bead Rekenrek

Presenting the Activity

1. Distribute Rekenreks to students.

2. Say to students:

    "In this activity, you're going to add two numbers on your Rekenreks to get a sum of 100.

"Show me 24 on your Rekenrek. Then tell me what number you need to add to make 100."

24 + 76 = 100

"I'll start by saying a number. For example, if I say 24, you will show 24 on your Rekenrek.

"Then, I want you to look at your Rekenrek to determine what number will make a sum of 100.

"What is that number? (Students respond: 76.)

"When you have determined the number, write a number sentence on your paper like this: 24 + 76 = 100."

3. Continue stating different one-digit and two-digit numbers and having students find the addend that makes 100.

4. Change the sum to 50 or some other multiple of 10, and repeat the activity.

⊘ Assessing Student Responses

The following questions will help you assess your students' responses to the activity:

- Did students correctly show the number on their Rekenreks? If not, what were the difficulties?

- Were students able to correctly find the missing addend that would give a sum of 100? If not, what were the difficulties?

- Were students able to correctly write number sentences for each problem?

15: Find the Difference

ⓘ Number of Students

Partner pairs

◈ Overview

Students draw two two-digit Number Cards and find the difference on their Rekenreks.

▣ Standard

Fluently add and subtract within 100 using strategies based on place value, properties of operations, and/or the relationship between addition and subtraction.

⊘ Materials

For each student:
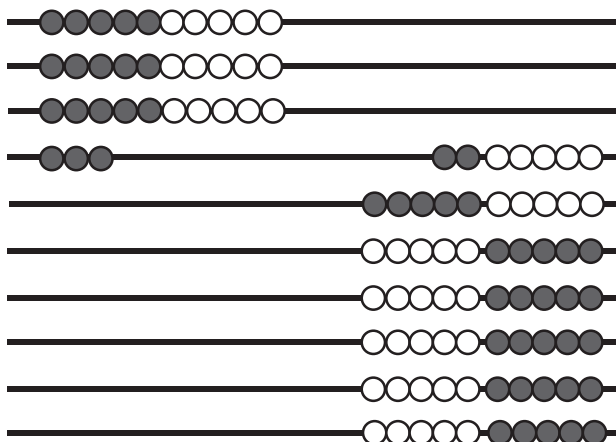• Student 100-Bead Rekenrek

For each pair:
• Number Cards 11–100 (pages 56–60)

Presenting the Activity

1. Make copies of the Number Cards on card stock and cut them apart. Randomly select 24 cards to make each deck.

2. Distribute a deck of cards to each pair of students.

3. Distribute Rekenreks to students.

72 – **39** = ?

4. Say to students:

"For this activity, you are going to use your Rekenrek to subtract two–digit numbers.

"Place the deck facedown so that you can both reach it.

"One of you will start by drawing two two–digit Number Cards. Identify the bigger number and show that number on your Rekenrek. Then use your Rekenrek to subtract the smaller two–digit number from the bigger two–digit number. Write a number sentence on your paper showing the subtraction.

"You and your partner will take turns drawing two numbers, finding the difference, and writing a number sentence for each subtraction until you have used all of your cards."

✓ Assessing Student Responses

The following questions will help you assess your students' responses to the activity:

- Did the students correctly show the two-digit numbers on their Rekenreks?

- Did the students correctly subtract the two two-digit numbers on their Rekenreks?

- Did students correctly write number sentences representing the problems?

- Did any particular numbers cause difficulties? For example, numbers in the 90s are often difficult for students to comprehend.

Number Cards 1–20

1	**2**	**3**	**4**
5	**6**	**7**	**8**
9	**10**	**11**	**12**
13	**14**	**15**	**16**
17	**18**	**19**	**20**

Number Cards 21–40

21	**22**	**23**	**24**
25	**26**	**27**	**28**
29	**30**	**31**	**32**
33	**34**	**35**	**36**
37	**38**	**39**	**40**

Number Cards 41–60

41	**42**	**43**	**44**
45	**46**	**47**	**48**
49	**50**	**51**	**52**
53	**54**	**55**	**56**
57	**58**	**59**	**60**

Number Cards 61–80

61	**62**	**63**	**64**
65	**66**	**67**	**68**
69	**70**	**71**	**72**
73	**74**	**75**	**76**
77	**78**	**79**	**80**

Number Cards 81–100

81	**82**	**83**	**84**
85	**86**	**87**	**88**
89	**90**	**91**	**92**
93	**94**	**95**	**96**
97	**98**	**99**	**100**

18: Find the Product

Number of Students

Partner pairs

Overview

Students interpret multiplication as repeated addition as they use their Rekenreks to find the product of two single-digit numbers.

Standards

- Use addition to find the total number of objects arranged in rectangular arrays with up to 5 rows and up to 5 columns; write an equation to express the total as a sum of equal addends.

- Interpret products of numbers, e.g., interpret 5 × 7 as the total number of objects in 5 groups of 7 objects each.
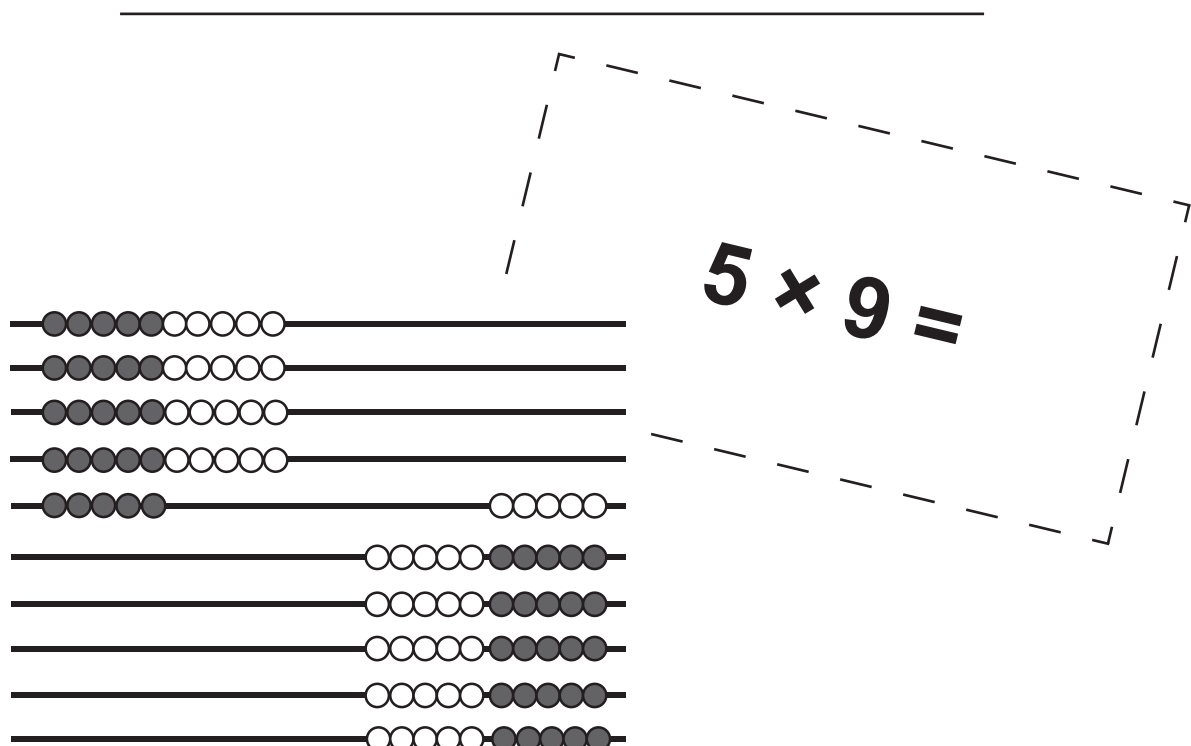
Materials

For each student:
- Student 100-Bead Rekenrek

For each pair of students:
- "Find the Product" Cards (pages 84–85)

Presenting the Activity

1. Make a copy of the "Find the Product" Cards on card stock for each pair of students. Cut the cards apart to form a deck.

2. Distribute Rekenreks to students.

3. Distribute a deck of cards to each student pair.

5 × 9 =

4. Say to students:

   "You are going to find the product of two numbers on your Rekenreks using repeated addition. When you have found the product, you will write the multiplication sentence on your paper.

   "Each of you will have 10 turns. So, number your papers from 1 to 10. Then you can write your number sentence for each turn."

5. Discuss with students what multiplication means. Say to students:

   "Let's do one together. For example, 4×6 means four groups of six or $6 + 6 + 6 + 6$. So what do you have to do on your Rekenreks? (Move 4 groups of 6 beads to the left.)

   "Try it! So what is the product? (24)

   "What number sentence do we write?" ($4 \times 6 = 24$) (Write the number sentence for all students to see.)

6. Do a few more examples with students. Then say:

   "Each pair gets a deck of 20 Product Cards.

   "One of you starts by drawing a Product Card. Use repeated addition on the Rekenrek to find the product. Make sure your partner agrees with your solution. Then write the correct multiplication equation on your paper."

7. Once all student pairs have found their products, discuss each of the 20 products.

8. If desired, make additional product cards on the blanks provided on page 94 and repeat the activity.

⊘ Assessing Student Responses

The following questions will help you assess your students' responses to the activity:

- Did students correctly use repeated addition on their Rekenreks to find the products? If not, what were the difficulties?

- Were students able to correctly write a number sentence for each problem?

"Find the Product" Cards

2 × 8 =	3 × 5 =
4 × 7 =	5 × 9 =
6 × 3 =	7 × 2 =
8 × 3 =	9 × 6 =
2 × 5 =	3 × 7 =

"Find the Product" Cards

4 × 9 =	**5 × 6 =**
6 × 8 =	**7 × 7 =**
8 × 5 =	**9 × 2 =**
2 × 7 =	**3 × 9 =**
4 × 4 =	**5 × 4 =**