

Kohlberg's **Digi-Block** **Mathematics** Lesson Plans and Worksheets

Volume 1: Pre-K and Kindergarten

First Edition

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Based on the teaching method developed by Elon Kohlberg, founder of Digi-Block

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About the Founder

Elon Kohlberg, Ph.D., is a mathematician and professor at Harvard Business School. Digi-Block was formed out of his passion for showing children the beauty and simplicity of elementary mathematics.

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Introduction

by Dr. Elon Kohlberg, Founder, Digi-Block

Digi-Block is a method for teaching Number and Operations. Its promise sounds too good to be true: Your students will have fun, they will experience the joy of figuring things out, and they will become proficient in the most demanding algorithmic procedures.

How is this possible? The key to number and operations is a clear grasp of our number system, in particular the notion of place-value. When a child understands the meaning of numbers written in base-10, then the operations we do with those numbers make sense.

Digi-Block provides a physical model of the number system that is so concrete that even four-year old children can easily manipulate it; at the same time it is so accurate that it provides a clear image of the algorithms, from simple addition and subtraction all the way to advanced procedures such as long-division and multiplication of decimal fractions.

A great advantage of working with Digi-Block is that the same physical model is used from kindergarten through sixth grade and beyond. Thus the child's experience and confidence are cumulative.

Since Digi-Block published its first teaching manuals, we have been elated to see the success and joy experienced by many teachers. However, these teachers had to work hard in order to translate our conceptual manuals into concrete teaching plans. Here, we provide a different kind of teaching manual. It is written with the recognition of the impossible demands on today's classroom teachers, which limit the time and energy available for creating their own teaching plans.

This book provides teaching plans for the first steps in the Digi-Block program. Children play with the blocks and use them to learn the concepts of kindergarten math. While all the activities are valuable in their own right, their greatest importance is in getting the children comfortable with the blocks. This way they will confidently make the transition to the more advanced work in later books.

In this book (volume 1) children start with the numbers 1-10, move to the teen numbers, then to addition and subtraction of numbers up to 20. The next book (volume 2) deals with numbers up to 100. It emphasizes the idea of blocks on a train, which is a particularly clear way to grasp two-digit numbers and their addition and subtraction.

The teaching plans and the worksheets in this book are based on more than five years' experience of a number of wonderful teachers, most notably Dotty Corbiere of the Meadowbrook School in Weston, Ma. There are no words to describe the excitement and the pride students experience in her math classes. We hope that this book will enable you to create the same experience in your own classroom.

Contents

For Teachers: A Brief Overview of Digi-Block Before You Begin	i
Getting Started: Numbers to 10	
1. Build & Explore: Introduction to Digi-Block	2
• Become familiar with the properties of Digi-Block	
• Learn how to pack a block-of-10	
2. Start with One and Count for Fun (1-10)	7
• Introduce the numbers 1-10	
• Place blocks in holders	
• Count blocks in holders	
3. Making Columns	21
• Place blocks in a pattern	
• Count sets (1-10)	
• Trace written numbers (1-10)	
4. Matching Single Blocks to Digits (1-9)	25
• Introduce one-to-one correspondence	
• Count blocks	
• Match numbers with corresponding digits	
5. Matching Objects to Digits (1-9)	29
• Reinforce one-to-one correspondence	
• Count blocks	
• Match numbers with corresponding digits	
6. Matching Objects and Blocks to Digits	33
• Reinforce one-to-one correspondence	
• Count blocks	
• Match numbers with corresponding digits	
7. Building Small Towers	37
• Count out (make a set of) a specific number of blocks	
8. Introduction to the Ten-Frame	41
• Recognize Ten-Frame organization of objects	
• Observe and explain a pattern	
• Observe that a different formation of a set of blocks does not change its quantity	
9. Practice Writing Numbers	53
• Practice writing numbers (1-10)	
10. Place, Count and Write	57
• Practice writing numbers (1-10)	
• Count (1-10)	
• Place blocks	
11. Introduction to the Number Line	68
• Introduce the number line as a way to count a set of blocks	
• Recognize digits (0-9)	
• Make a set on the number line for a given number	
12. Countdown to Zero - Take Away One More!	70
• Introduce the concept of zero	
• Count down by ones	
13. Placing Blocks in a Ten-Frame	71
• Recognize spoken numbers	
• Make a set of blocks from a spoken number	
• Arrange blocks in a Ten-Frame	

14. Find the Missing Number	73
• Practice writing numbers (1-10)	
• Counting (1-10)	
• Identify missing numbers in a sequence	
15. Counting a Collection of Objects (1-9)	77
• Place blocks with one-to-one correspondence	
• Count (1-9)	
• Write digits	
16. Filling in Ten-Frames	84
• Make a set of blocks for a given number (0-10)	
• Review correct ten-frame organization	
• Put the numbers 0-10 (and visual models of each) in order	
17. Coloring Objects in a Set (1-9)	92
• Identify numbers	
• Make corresponding set of objects	
18. Coloring Blocks in Holders (1-10)	96
• Identify numbers (1-10)	
• Make a corresponding set of objects	
• Fill in outlines to represent the set	
19. Matching Blocks in Holders to Numbers (1-10)	99
• Match quantities of blocks with written numbers	
20. Connect the Dots (1-10)	102
• Recognize and connect written numbers 1-10 in order	
21. Drawing Blocks in a Ten-Frame Formation	107
• Make a set of blocks for a given number (0-10)	
• Arrange blocks in the ten-frame formation without using a ten-frame guide	
• Draw a set of organized blocks	
22. Ten-Frame Block Bingo	111
• Recognize spoken numbers (1-10)	
• Count sets of blocks (1-10)	
23. Small Shape Puzzles	115
• Fill shape with blocks	
• Count	
• Write numbers (5-10)	
24. Drawing Sets of Blocks (1-9)	120
• Number recognition (1-9)	
• Make sets of specific numbers of blocks	
• Represent sets through drawing objects	
25. Dots on Number Cubes	123
• Copy a pattern	
• Count dots	
• Make a corresponding set of blocks	
26. Early Number Bingo	125
• Recognize numbers (1-9)	
27. Count and Match	128
• Use number line to count blocks	
• Reinforce writing the digits	
• Reinforce digit recognition	
28. Ordering Small Numbers	132
• Order numbers	
• From a given number, make a set	

29. Introduction to Estimation	135
• Estimate the number of blocks needed to fill a space	
• Fill a space with blocks	
• Count a set of blocks	
30. Picture Pieces	139
• Sort/categorize pictures	
• Count blocks	
• Write numbers	
31. Word Bingo (1-9)	147
• Recognize written names of numbers (1-9)	

Chapter 1: Numbers to 20

1. Start with One and Count for Fun (11-20)	150
• Introduce the numbers 11-20	
• Familiarize students with the word names, numbers and sequence of numbers 1-20	
2. Make it the Same	162
• Count (1-20)	
• Fill holders with blocks to match drawings	
• Trace numbers (1-20)	
3. Counting Blocks on a Number Line	166
• Place blocks with one-to-one correspondence	
• Count a set of blocks on a number line	
• Use a number line to determine a quantity	
• Use a number line to count	
4. Blockimals	170
• Place blocks with one-to-one correspondence	
• Count (10-20)	
• Write numbers (10-20)	
5. Teen Bingo	174
• Recognize numbers (1-20)	
• Recognize patterns (four in a row)	
6. Classify and Count Shapes	178
• Recognize basic geometric shapes	
• Sort objects by one attribute	
• Place blocks with one-to-one correspondence	
• Count blocks	
• Write numbers	
7. Shape Puzzles	183
• Fill shape puzzles with blocks	
• Count	
• Write numbers	
8. Connect the Dots (1 - 20)	187
• Recognize written numbers in order	
9. Bar Graphs	190
• Use classroom data to make simple bar graphs	
• Collect and organize data	
• Make a set of blocks of a given number	
• Arrange blocks to model a graph	
10. Introduction to Inequality Signs	194
• Compare two numbers	
• Use inequality signs	

11. Comparing Numbers and Sets with Inequality Signs	202
• Make a set for a given number	
• Compare two numbers	
• Use inequality signs	
12. Introduction to Combining Groups	208
• Introduce the basic operation of addition	
• Introduce the “+” sign as an instruction to combine sets	
• Given a number, make the equivalent set of blocks	
• Count sets of blocks	
13. Combining Groups - Introduction to the Number Sentence	212
• Combine sets of blocks	
• Write the number for a given set	
• Introduction to the number sentence	
• Introduce students to the word sum	
14. Combining Ten-Frames	216
• Combine sets of blocks to find the sum using ten-frames	
• Color in ten-frames to correspond to sets of blocks	
• Count blocks and write correct numbers	
15. Addition Using Ten-Frames	221
• Represent given numbers in a ten-frame	
• Make a visual model of addition with ten-frames	
16. Addition on the Number Line	226
• Introduce students to the number line as a means to add	
• Review the “+” sign as an instruction to combine sets	
• Review the word sum	
• Write number sentences to record work	
17. Mental Addition with Ten-Frames	230
• visualize numbers in ten-frame formation	
• visualize addition with ten-frames (including breaking numbers into fives)	
• Complete basic addition problems	
18. Introduction to Subtraction	235
• Introduce students to the basic operation of subtraction	
• Introduce the “-” sign as an instruction to separate sets	
• Introduce students to the word difference	
• Learn that subtraction undoes addition	
19. Slide Off! Subtraction on the Number Line	239
• Use subtraction as the whole take away a part or as the separation of a part from the whole	
• Use number lines to model subtraction	
• Use number sentences to record work	
20. Directional Bingo	241
• Writing the teen numbers	
• Introduction to directional words	
Appendix	243
Bookmark (to make three two-sided bookmarks to be laminated)	
Number Line (0-10)	
Number Line (10-20)	
Ten Frame (1)	
Ten Frame (2)	
Blocks in Holders (10 dotted blocks)	
Blocks in Holders (1-10)	

For Teachers: A Brief Overview of Digi-Block Before You Begin

Digi-Block is a hands-on system for teaching elementary math. Math is easier and more fun when students can **see** the base-10 number system. The National Council of Teachers of Mathematics (NCTM) recently revised its standards, renewing its emphasis on developing strong number sense early on. Using Digi-Block in your classroom will enable you to effectively model patterns in counting, to show how numbers “compose” and “decompose,” to demonstrate basic operations to and give meaning to the concept of place value. Digi-Block enables students to model, visualize, represent and **explain** the most fundamental concepts of number sense.

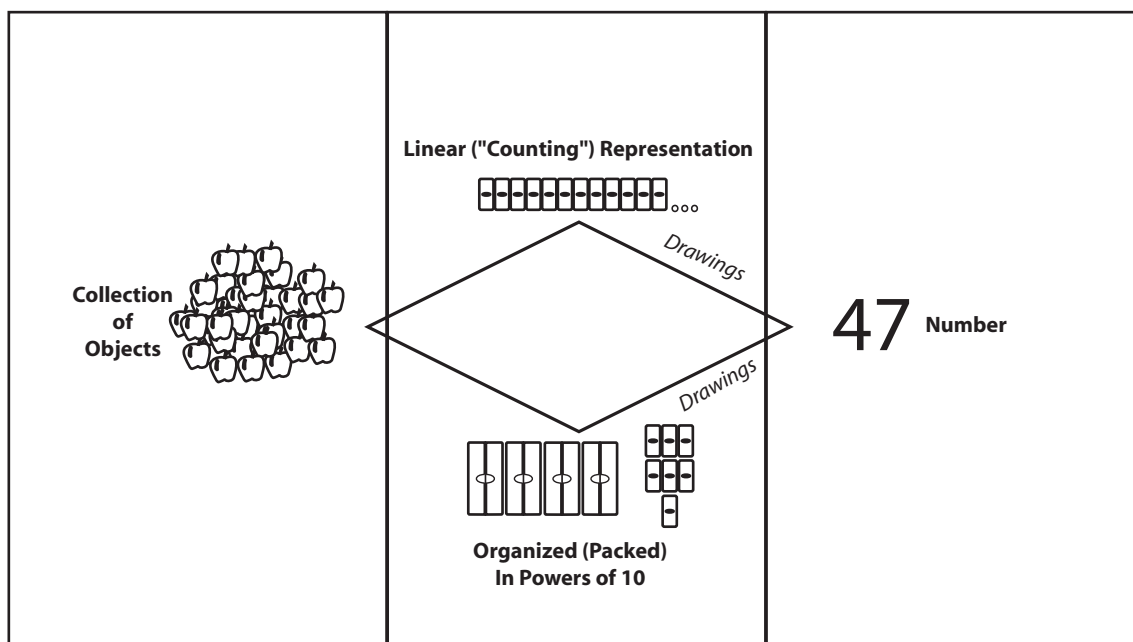
The aim of this book is to break the Digi-Block curriculum into straightforward daily lessons with ready-to-use worksheets. The lessons are presented chronologically to minimize teacher prep time. However, we strongly recommend that you become familiar with the overall Digi-Block method, preferably by participating in an in-service training, by consulting the tutorials on our website and/or by reading the *Comprehensive Teacher’s Guide*.

The Basic Building Blocks

At the core of the Digi-Block program is a system of small rectangular blocks and empty holders. These materials enable children to discover for themselves the important relationship between ones and tens. When the smallest holder is filled with exactly ten single blocks and covered with another holder, it forms a new block. This block-of-10 looks just like a single block except that it is ten times as large. Ten of these blocks-of-10 can then be packed into a larger holder to create a block-of-100, which is, again, ten times as large. These blocks-of-100 then pack into the largest holders to make a block-of-1000 with the same repeating shape.

Modeling Numbers

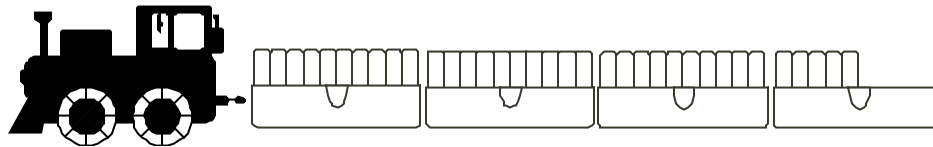
A number can be represented in four ways (see graphic). Ultimately, students should be able to make the transition from one representation to another, completing problems with physical models, drawn models, and numerical representations.



The Train Model

Trains are made by placing small holders in a line behind an imaginary engine. These small holders become the cars of the train. The main rule for trains is that **all blocks must be loaded from left to right as close to the engine as possible**, thereby simulating a number line. The holders organize the blocks in groups of ten, which fosters students' learning of several key concepts, including:

- Recognizing full cars (tens) as separate units from individual blocks (ones)
- Counting by ones
- Counting by tens
- Grouping tens with tens and ones with ones for efficiency when adding and subtracting



A “good” train

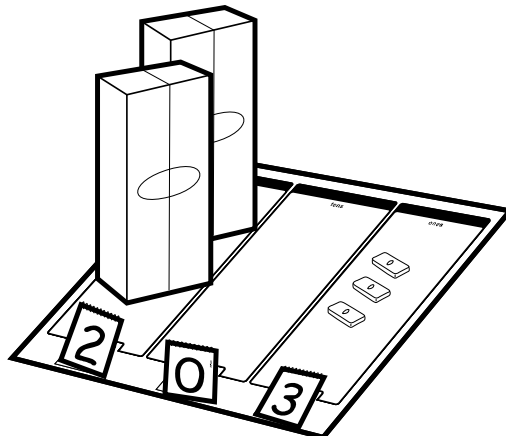
Train engine cut-outs are available in the Appendix of Volume 2, as trains are introduced in Volume 2.

The Packed Blocks Model

When students are proficient counting and doing addition and subtraction with trains, students can **cover the full cars**, thus making **blocks-of-10**. It is essential that students first master these skills with trains when they can see individual blocks in each holder before advancing to the **packed view**, when they must know intuitively that ten ones and one ten are equivalent.

Working with packed blocks helps students understand that:

- each unit contains ten of the next smallest unit and that this pattern could extend infinitely in either direction
- a set of blocks is packed as much as possible when there are no more than nine of any size showing
- blocks should be organized by grouping them by size and by arranging them in descending order
- each digit of a number represents how many of each size there are
- zeros are essential placeholders

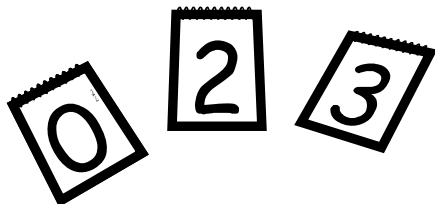


Place Value Mat with Blocks and Digit Flip Cards

Additional Materials

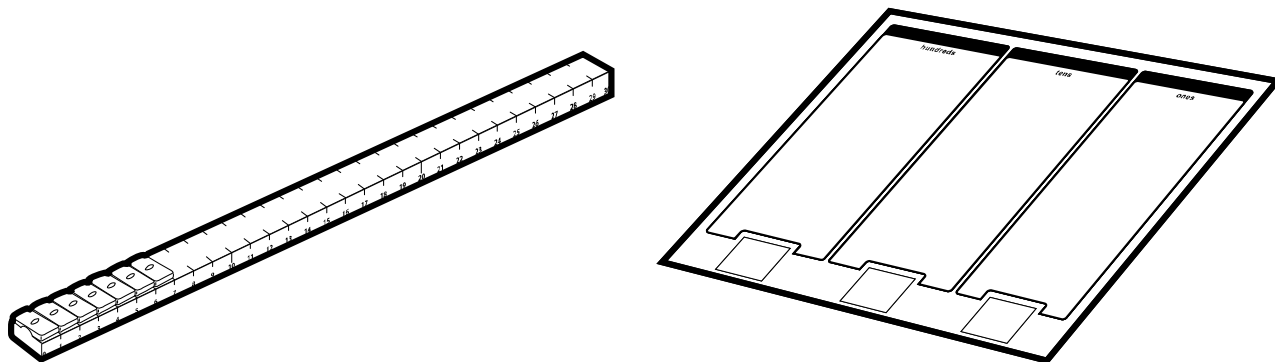
Digit Flip Cards

Digi-Block Digit Flip Cards are spiral bound cards, one each for the digits 0-9. They are initially used to recognize the digits and then to recognize that there can be only one digit in each place. When the 9 digit card is reached, the next flip will reveal the 0 digit again, signaling the need for an additional set of cards to represent the tens place. Paper digit flip cards can be substituted if your classroom does not have Digi-Block Digit Flip Cards.



Number Lines

Digi-Block Number Lines (0-30) hold single blocks flat along the top surface. One face shows hash marks with the numbers 0-30; the opposite face shows only hash marks. The tabs at each end and the top coating of the plastic number lines keep the blocks from sliding off. This type of number line is much more concrete than the traditional number line because the students are counting the number of blocks rather than the abstraction of a line or a space between lines. Paper number lines (provided in appendix) can be substituted if your classroom does not have Digi-Block Number Lines.

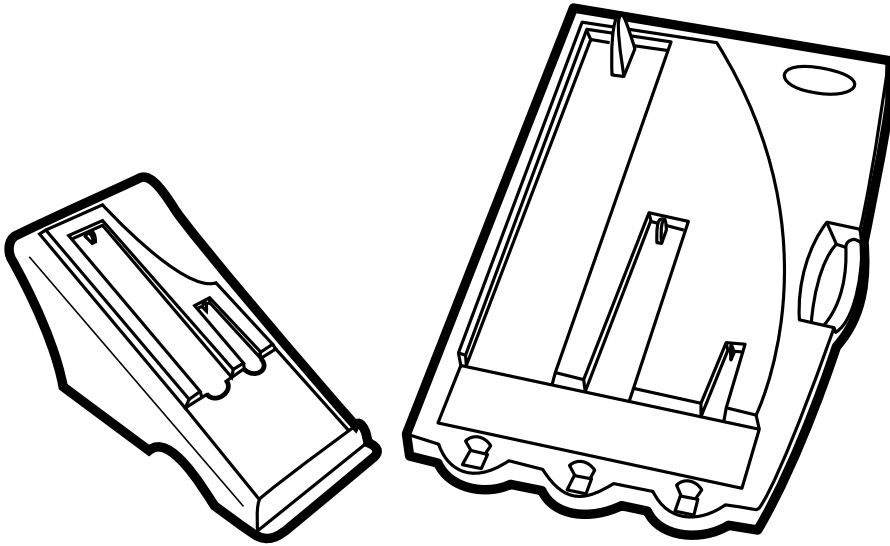


Place Value Mats

The Digi-Block Place Value Mat is an 18" x 14" laminated mat for organizing the blocks into places. The folding mat has three panels labeled Hundreds, Tens and Ones with designated areas for Digit Flip Cards at the bottom of each place. The mat can be written on with dry-erase markers. Place value mats are not introduced until Book 2. Paper templates for photocopying will be provided in the Book 2 Appendix if Digi-Block Place Value Mats are not available in your classroom.

Counter

The counter is an excellent way to **organize packed blocks** for counting, addition and subtraction. One holder of each size is held in place so that single blocks can only be loaded into the ones' place, blocks-of-10 can only be loaded into to the tens' place, and blocks-of-100 can only be loaded into the hundreds' place. Each holder can hold up to nine blocks. When a tenth is inserted, the holder “pops out” and slides down the ramp, signaling the student to put a cover on it, converting ten units into one of the next unit, and to load it in the next column. Students and teachers alike love the “eject” mechanism!



2-Place (Student) Counter and 3-Place (Demonstration) Counter

In recognition that the only Digi-Block materials some classrooms may have is blocks, this book was purposely designed to require only blocks. Since the counter can not be made from paper as the number lines, digit flip cards and place value mats can, the counter is not used in the lessons in this book. However, it is a valuable tool that students love to use. *Pattern of the Count* is an excellent Kindergarten lesson that uses the counter. It and other additional lessons can be found on the Digi-Block website in the “Lesson Plans and Activities” section.