CHAPTER 4: Addition and Subtraction of Two-Digit Numbers

Introduction

In this chapter, teachers explore what young children learn about the addition and subtraction of two-digit numbers in the early grades. Teachers are encouraged to complete the mini-modules in order. Teachers will benefit more from this chapter if they have already completed *Chapter 2: Foundations of Addition and Subtraction* and *Chapter 3: Place Value*.

Mini-Modules in This Chapter

A) Developing strategies for two-digit addition and subtraction
B) Standard algorithm for adding two-digit numbers without regrouping
C) Standard algorithm for adding two-digit numbers with regrouping
D) Standard algorithm for subtracting two-digit numbers without regrouping
E) Standard algorithm for subtracting two-digit numbers with regrouping

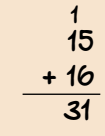
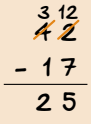
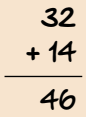
Goals of the Chapter

This chapter aims to help teachers:

- Identify and describe how students learn multiple strategies for adding and subtracting two-digit numbers.
- Identify and describe how students learn to add and subtract two-digit numbers using place value.
- Identify how to teach the standard algorithms for addition and subtraction, using materials and vertical addition/subtraction.
- Develop new teaching practices.

Key terms

Algorithm	A process or set of rules to be followed when doing calculations
Borrow	To change a group of ten into 10 ones and add to the ones, when using the standard algorithm for subtraction (also called *regroup*)
Carry over	To change 10 ones into a group of ten and add to the tens when using the standard algorithm for addition (also called *regroup*)
Horizontal addition/ subtraction	An addition or subtraction problem written from left to right: 32 + 14 = 46
Manipulatives	Real objects that can be held and moved around

Regroup	The process of changing a group of ones into ten, or a group of ten into ones when using the standard algorithm; sometimes called *rename, exchange, borrow* (in subtraction), or *carry over* (in addition)
Standard algorithm for addition	A process for addition that uses place value and regrouping. It involves: 1. Writing a vertical addition problem 2. Adding the digits from right to left (starting with the ones) 3. Regrouping from ones to tens (carrying over) when necessary 
Standard algorithm for subtraction	A process for subtraction that uses place value and regrouping. It involves: 1. Writing a vertical subtraction problem 2. Subtracting the digits from right to left (starting with the ones) 3. Regrouping from tens to ones (borrowing) when necessary 
Vertical addition/ subtraction	An addition or subtraction problem written with digits in columns based on place value, which can be solved using the standard algorithms. 

Strategies for Addition and Subtraction

It is best for children to learn and practice with a variety of problem-solving strategies before they learn the standard algorithms. They should be encouraged to use different strategies, and to combine strategies, to reach the answer. They may use their own thinking, manipulatives, or pictorial materials like a 100 chart. In the mini-modules in this chapter, you will be introduced to some specific strategies that children can use before learning the standard algorithm.

The standard algorithm is abstract for children. It is best to demonstrate it using place value materials like sticks first. This helps students understand how to add or subtract ones and tens and how to regroup. This will help them develop a good understanding of how the standard algorithm works before they use vertical addition or subtraction. Children may also continue using the other strategies that they have learned, in combination with vertical addition and subtraction. With practice, they will be ready to add or subtract by choosing appropriate strategies, including solving problems mentally, using materials, or in writing.

Connections with Other Mathematical Concepts

COMPOSITION AND DECOMPOSITION

A good understanding of how to compose and decompose numbers helps children add and subtract single-digit numbers. Children also learn how to compose and decompose two-digit numbers into their parts, especially tens and ones. Being able to compose and decompose two-digit numbers helps children add and subtract accurately, especially when doing mental math.

FOUNDATIONS OF ADDITION AND SUBTRACTION

Children should learn how to add and subtract single-digit numbers (e.g., 4 + 3 = 7) before they add or subtract two-digit numbers. They should already understand the concepts of addition and subtraction well, recall addition and subtraction facts from memory, and use the symbols (+ – =). They should also be able to use strategies to add and subtract one-digit numbers mentally, in case they do not recall an addition or subtraction fact.

PLACE VALUE

It is important that children understand the place value of tens and ones when learning to add and subtract numbers with two digits. To add or subtract accurately, they must add or subtract the digits with the same place value. Children should be taught to add and subtract with place value materials first, before they learn vertical addition and subtraction.

ADDITION AND SUBTRACTION OF NUMBERS WITH MORE THAN TWO DIGITS

Adding and subtracting any numbers with multiple digits requires a good understanding of place value. Children first learn to work with two-digit numbers before adding and subtracting numbers with three digits and more. The concepts and procedures are the same, so when children learn how to add and subtract two-digit numbers with fluency, they will be prepared to add and subtract larger numbers.

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