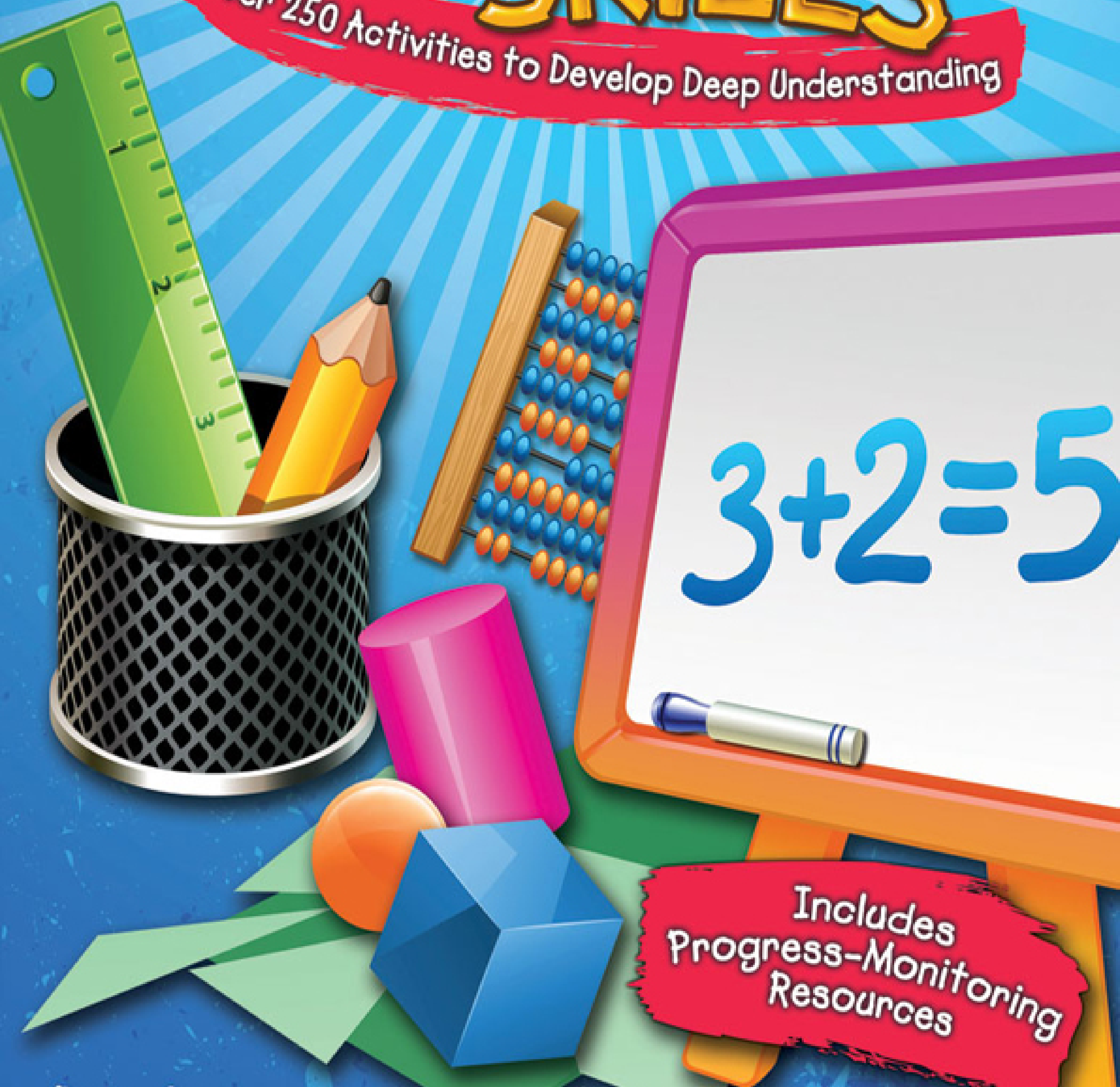
Shell Education

Levels Pre-K–3

# Essential MATH SKILLS

## Over 250 Activities to Develop Deep Understanding

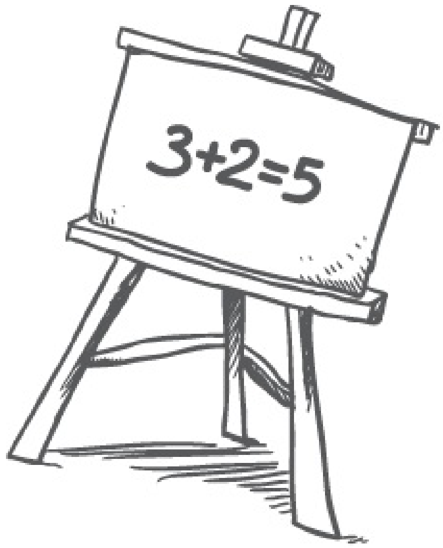



Includes Progress-Monitoring Resources

Bob Sornson

# Table of Contents





# Research

Some math skills are simply essential to understanding numbers and how they work. These are the skills that might be considered the "core of the Core." They must be well understood, or a student will be forever compromised as he or she moves forward through more complex mathematics.

When learning these foundational math skills, racing through content is not a suitable plan for instruction. For these essential skills, "drill and kill" is not acceptable. The foundation for loving math for life must be built on success and joyful learning.

> *U.S. curricula typically include many topics at each grade level, with each receiving relatively limited development, while top-performing countries present fewer topics at each grade level but in greater depth. In addition, U.S. curricula generally review and extend at successive grade levels many (if not most) topics already presented at earlier grade levels, while the top-performing countries are more likely to expect closure after exposure, development, and refinement of a particular topic.*
>
> —*National Mathematics Advisory Panel* (20, 2008)

For decades, our schools have been engaged in a failed experiment that has attempted to cram more content into the time available for instruction than is humanly possible. Most schools have asked students to learn overwhelmingly complex content at younger and younger ages without carefully building the foundational skills needed for learning success.

Early childhood is the crucial time during which one builds the foundational skills, behaviors, and beliefs that establish one's path as a learner for life. Sadly, for many young students, our teaching systems are not working effectively. By the beginning of fourth grade, the point at which we can accurately predict long-term learning outcomes, only 40 percent of American students perform at proficient levels in mathematics. By eighth grade, this has decreased to 35 percent student proficiency, and by twelfth grade, only 26 percent of students remaining in school perform at or above a proficient level in mathematics (National Assessment of Educational Progress 2009 and 2011).

The long-term effects of such numbers of American students lacking proficiency in mathematics in the information age may be disastrous. Low-skill learners become low-skill workers with low wages. Early learning success in reading and mathematics is correlated with high school graduation, going on to advanced education, lower rates of substance abuse and other high-risk behaviors, decreased criminality, stable adult relationships, and success on the job (Hernandez 2011; Shore 2009a; Shore 2009b; The Annie E. Casey Foundation 2010). The costs of allowing three-quarters of our students to remain nonproficient in math include diminished employment options for our students and reduced prosperity for our society.

With the belief that many more math students could deeply understand basic math skills, become successful math students, and enjoy using mathematics in their lives, the Early Learning Foundation set out to identify those nonnegotiable skills that need to be deeply understood in order for a student to have continued success in math learning. The foundation began with backward planning; as an example, researchers asked second-grade teachers which firstgrade skills were absolutely needed for success in second grade. Instead of long lists of content standards to "cover," these teachers identified the core skills that provide learning readiness for ongoing mathematics instruction.

The sequential nature of learning in mathematics provides a beautiful framework for what is essential. The skills identified by teachers matched the accepted theoretic framework for the development of mathematical learning. By experimenting with the exact wording of the skills and the rubrics in several schools in three districts, over a three-year period, researchers refined an inventory of essential skills for success in mathematics and a corresponding rubric to assess students' mastery of those skills. With more years of experience in additional schools, the rubric has been further refined so that it can be implemented with any high-quality mathematics curriculum.

By identifying crucial skills and encouraging teachers to take all the time needed to help students develop these skills, teachers began to observe that incoming students were better prepared than ever before, and scores on state or standardized tests increased dramatically. Equally important, more students enjoyed math and saw themselves as successful math learners.

The goals of using the Essential Math Skills Inventories are:

- Identify the essential math skills in sequence and at each level.
- Provide a concise set of outcomes that can be systematically tracked using teacher observation and ongoing formative assessment.
- Help teachers remember that students learn best while learning in the instructional zone, which includes a small element of challenge along with the experience of understanding and success.
- Give teachers data to reinforce the need to allow students sufficient time to learn a skill.
- Provide a structure to help teachers verify proficiency so that they can know how to plan differentiated instruction in mathematics based on students' individual readiness levels and when to move them along to more challenging math learning activities.

Every school district has an instructional framework for what should be covered at each grade level. But essential skills deserve more than coverage. They must be learned to a level of deep understanding and application. They are the core of the Common Core. They provide a framework for formative assessment, allowing teachers to monitor progress toward those crucial outcomes. These skills are the solid foundation we want for every child.

# The Essential Math Skills

# for Grades Pre–K–3

| Pre-Kindergarten Skills | |
|---|---|
| **Skill 1:** Demonstrates one-to-one correspondence for numbers 1–10, with steps<br>**Skill 2:** Demonstrates one-to-one correspondence for numbers 1–10, with manipulatives | **Skill 3:** Adds on, using numbers 1–10, with steps<br>**Skill 4:** Adds on, using numbers 1–10, with manipulatives |
| **Kindergarten Skills** | |
| **Skill 5:** Demonstrates counting to 100<br>**Skill 6:** Has one-to-one correspondence for numbers 1–30 | **Skill 7:** Understands combinations (within 10)<br>**Skill 8:** Recognizes number groups without counting (2–10) |
| **Grade 1 Skills** | |
| **Skill 9:** Counts objects with accuracy to 100<br>**Skill 10:** Replicates visual or movement patterns<br>**Skill 11:** Understands concepts of adding on or taking away (within 30), with manipulatives | **Skill 12:** Adds/subtracts single-digit numbers on paper<br>**Skill 13:** Shows a group of objects by number (to 100) |
| **Grade 2 Skills** | |
| **Skill 14:** Quickly recognizes groups of objects (to 100)<br>**Skill 15:** Adds to/subtracts from a group of objects (within 100) | **Skill 17:** Counts by 2, 3, 4, 5, and 10, using manipulatives<br>**Skill 18:** Solves written and oral story problems using the correct operations *(addition and* |

| | |
|---|---|
| **Skill 16:** Adds/subtracts two-digit numbers on paper | *subtraction)*<br>**Skill 19:** Understands/identifies place value to 1,000 |
| **Grade 3 Skills** | |
| **Skill 20:** Reads and writes numbers to 10,000 in words and numerals<br>**Skill 21:** Uses common units of measurement: length, weight, time, money, and temperature<br>**Skill 22:** Adds/subtracts three-digit numbers on paper with regrouping<br>**Skill 23:** Rounds numbers to the nearest 10<br>**Skill 24:** Rounds numbers to the nearest 100 | **Skill 25:** Adds/subtracts two-digit numbers mentally<br>**Skill 26:** Counts by 5, 6, 7, 8, 9, and 10 using manipulatives<br>**Skill 27:** Uses arrays to visually represent multiplication<br>**Skill 28:** Recognizes basic fractions<br>**Skill 29:** Solves written and oral story problems using the correct operation *(addition, subtraction, and grouping)* |

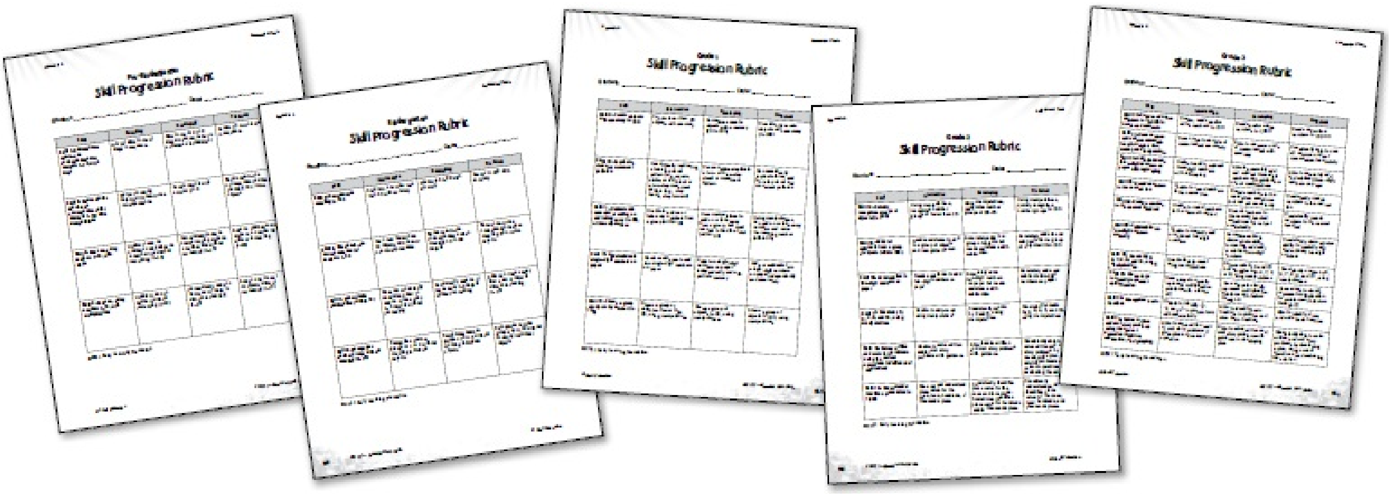
# Implementing *Essential Math Skills* in the Classroom

*Essential Math Skills* is designed to help students develop the numeracy skills that will allow them to understand math, love math, and succeed in the information economy. The activities in this book provide a rich menu of mathematical learning experiences that include the use of manipulatives, exploration, inquiry, and play.

*Essential Math Skills* allows teachers to:

- Understand the sequence of essential early math skills
- Identify the essential early math skills by grade level
- Determine which skills each student has mastered
- Design responsive instruction to meet the needs of each student
- Understand which skills require additional instructional experiences
- Systematically monitor progress toward proficiency in every essential skill
- Advance students as soon as they are ready for more complex instruction
- Help each student develop a solid foundation of mathematical skills and concepts
- Help many more students fall in love with math for life

Using *Essential Math Skills* is simple. The *Skill Progression Rubrics* (see Appendix A) will help the teacher identify the skills that each student has already developed to proficiency, and then the teacher can plan instruction based on the learning readiness of the students. Skill-specific activities offer many different options for engaging students in learning that is challenging but never overwhelming.



## Using the *Essential Math Skills* Inventories

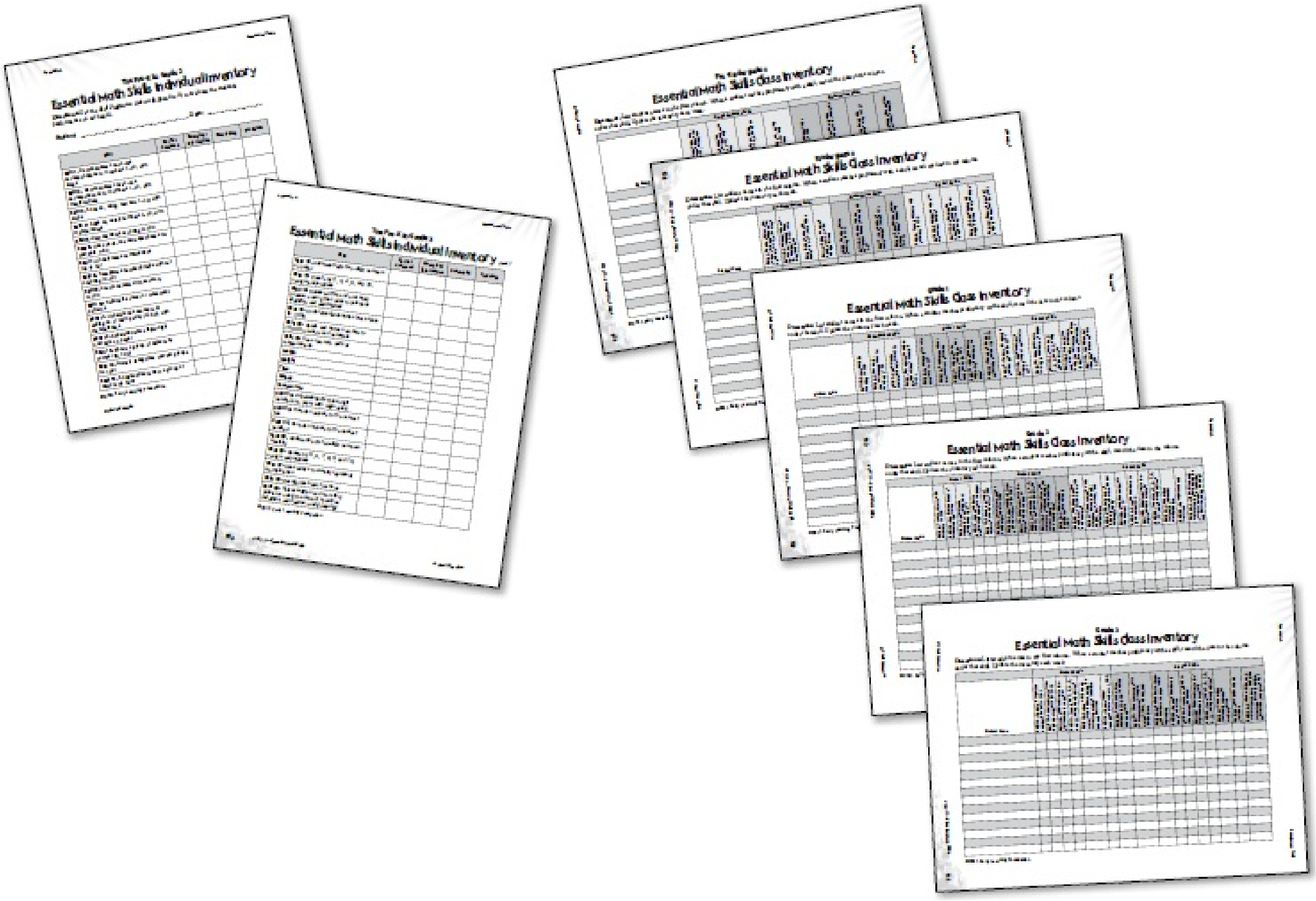
The *Essential Math Skills Class Inventories* (pages 137–141; see digital resources on page 168) and the *Essential Math Skills Individual Inventory* (pages 135–136; individualinventory.pdf; individualinventory. xls) offer simple formats for systematically assessing the 29 most crucial skills in the development of early mathematical literacy. The inventories serve as ongoing formative assessment tools for identifying specifically what students know and what they are ready to learn. These skills are at the core of mathematical literacy and cannot be merely "covered." They are the skills students must learn to a level of deep understanding and application, and the foundation upon which a lifetime of successful mathematical learning will be built.

Classroom teachers will use the *Essential Math Skills Class Inventory* as their primary math-data collection tool. This will give teachers all the information needed to understand the learning readiness and needs of every student in the class on one page, allowing for welldesigned instruction that meets the specific needs of the students. Classroom teachers can use the *Individual Essential Math Skills Inventory* to communicate with parents about the learning progress of individual students. Teachers are advised not to show class inventory data to parents since this would compromise the privacy of other students and could create unnecessary competition. When working with students with a wide range of skills, special education or intervention instructors may wish to use the *Individual Essential Math Skills Inventory* as their primary math-data collection tool. This would require monitoring more inventories but would also allow those teachers to accurately track the varied learning needs and progress of individual students.

1. During the first few weeks of school, **use observational, informal, and instructional assessment to collect baseline data**. Using the *Skill Progression Rubric* for your grade level (Appendix A), determine which grade-level skills each student has already developed proficiency in and which may need intensive support. Determine which students may need to spend time further developing a skill from a previous grade. **Note:** *The* Essential Math Skills Class Inventory *allows the teacher to monitor progress on skills that are one grade level below and one grade level above the current grade.*
2. **Use the *Proficiency Checklist*** (page 142) to keep track of students' progress toward proficiency in a skill.
3. **Update the class inventory each week.** Systematic formative assessment is necessary for responsive instruction. Note when proficiency is achieved for each student by recording the date on the inventory. Student proficiency should be documented only after the student has demonstrated **proficiency for a skill on at least three occasions, using more than one type of instructional activity.** Be certain that a student deeply understands a skill and can apply it in multiple scenarios before confirming proficiency.
4. **Use individual student data to communicate with parents.** The individual inventory allows teachers to evaluate students' performance on skills as *Emerging/Intervention*, *Developing*, or *Proficient.* Teachers can ask parents to support the development of crucial skills at home. Suggestions for ways parents can do this can be found in the *Family Letter* (page 165).
5. **Use the data to plan instruction.** Refer to this information as you formulate weekly or daily lesson plans. With the knowledge of which students are proficient, developing, or need intensive support in certain skills, teachers can design small-

group lessons, centers, and activities to meet the specific needs of the students.

6. **Work to help students reach or exceed proficiency in every grade-level skill** by the end of the school year. Students will undoubtedly move through the skills at varying rates; some will need many more experiences with a skill to reach proficiency than will others. Many students will exceed grade-level standards and be ready to move on to more advanced skills on the inventory.



# How to Use This Book

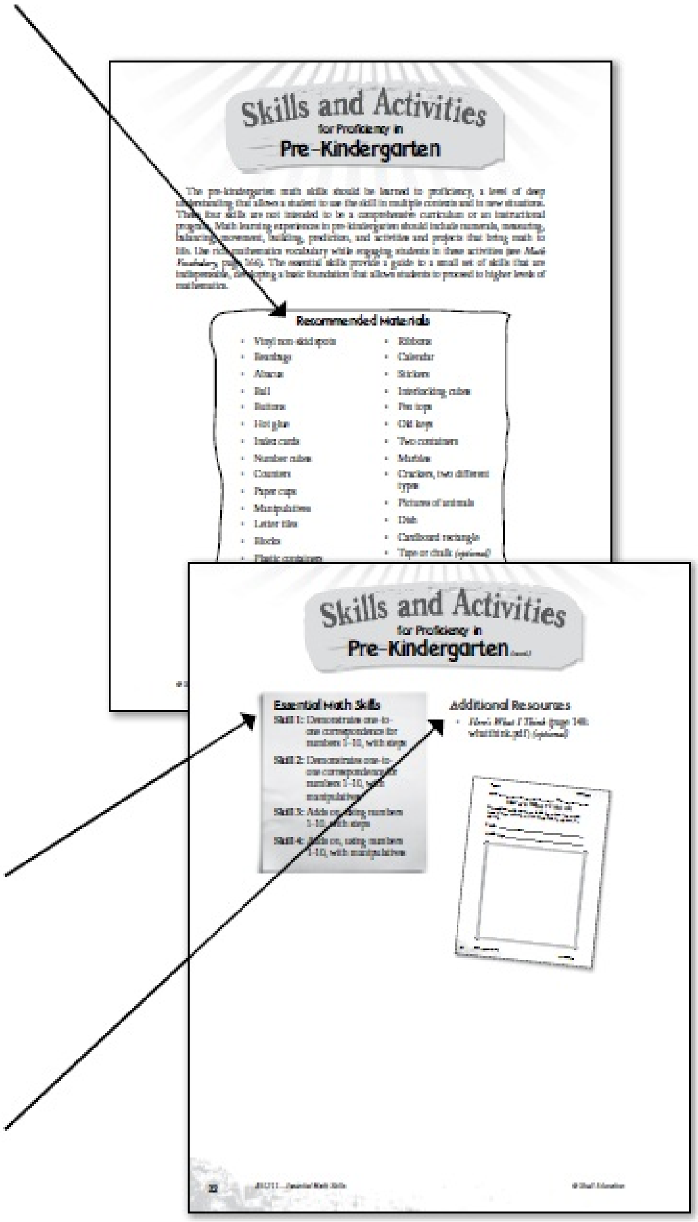
## Skills and Activities Overview

The **divider page** at the beginning of each grade-level section offers an overview of the skills and materials needed for the activities.

The **Recommended Materials** lists all resources that are necessary to lead students in the activities for the grade level. **Note:** *Several activities within this resource use a 10-by-10 counting frame, usually called an* abacus. *This tool is used to learn the value of numbers using a base-ten format and to support a deep understanding of basic computation. The abacus allows students to understand the feeling of moving a number value, see base-ten displays of number values, and see the relationship between number values used in addition, subtraction, and grouping. Some teachers may remember the days when every early childhood classroom had a large classroom abacus. For others, this will be a new and exciting tool that allows students have a kinesthetic, visual, and auditory experience to help them deeply understand basic mathematical processes.*

The **Essential Math Skills** lists the focus skills for each grade level. These are the core skills with which students must be completely proficient so that they can understand and enjoy mathematical learning.

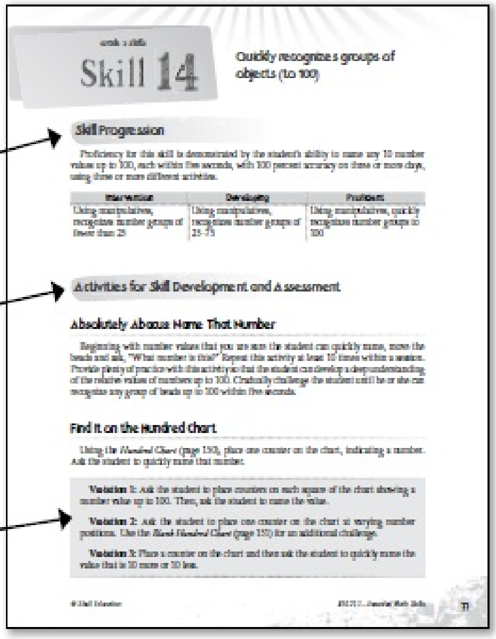
The **Additional Resources** lists activity sheets that are provided in the appendix or on the Digital Resource CD and that support the activities for the grade level.



The **Skill Progression** defines proficiency for each skill and provides a concise rubric for evaluating students' progress toward mastery.

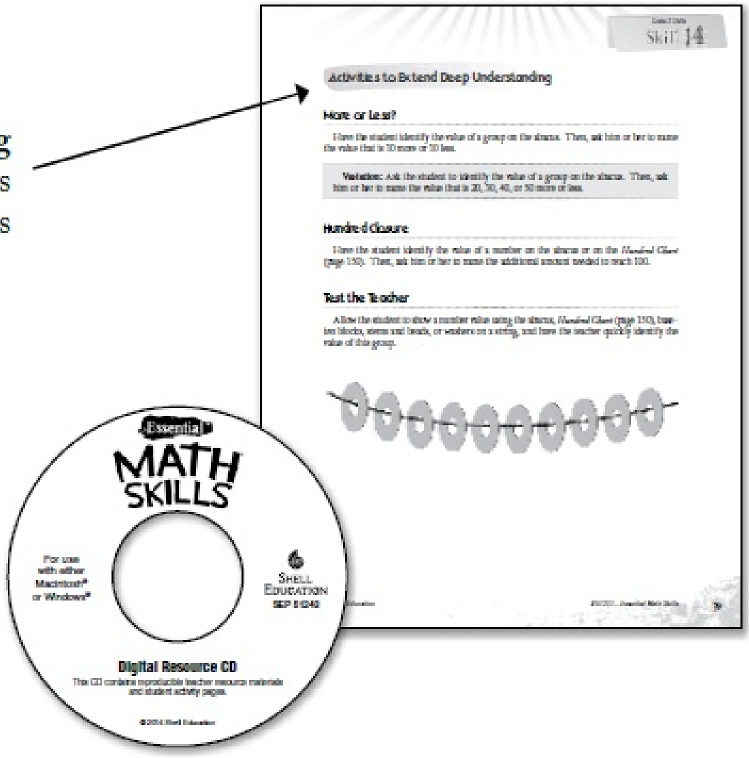
The **Activities for Skill Development and Assessment** section offers detailed descriptions of the activities and experiences that will enable students to reach proficiency in a skill.

**Variations** offer creative modifications that allow activities to be revisited for additional practice.




**Activities to Extend Deep Understanding** offer ideas to extend the skill after students have shown proficiency through the Activities for Skill Development and Assessment.

The **Digital Resource CD** offers resources such as student activity sheets and data-recording tools.



# Tips for Planning Instruction and Assessment in Mathematics

Let's help the next generation of students fall in love with math. Learning about numbers and mathematical thinking should be about exploration and inquiry, and patterns and play. Consider the following recommendations when planning mathematics instruction for students in the early grades.

- **Plan instructional activities and projects that the student can do with a high rate of success.** Students work harder and longer and stay far more engaged when they are good at a task. Generally, students should experience success at least 90 to 95 percent of the time to stay in the optimal state of mind for maximum effort and learning. Don't push too fast and cause students to move out of this optimal learning state.
- **Include movement and manipulatives in your instruction.** Students need concrete learning experiences, including those that involve lifting, stepping, carrying, touching, hearing, and seeing. As students advance, plan instruction that allows them to see the solution to a problem with manipulatives (e.g., an abacus, a ten-frame, beads, or blocks) and then write the solution to the problem on paper. Students need to understand mathematical concepts at the concrete level before they will truly understand them at the symbolic level.
- **Encourage students to justify their thinking and reasoning.** Ask students to explain the choices they make while problem solving. Encourage them to share the reasoning behind their solution paths. Have students justify their responses whether their answers are correct or incorrect. Use the *Here's What I Think* activity sheet (page 148) with any activity when you want students to record their reasoning on paper.
- **Carefully monitor each student for engagement, interest, success, and frustration.** This is called *observational assessment* or *formative assessment.* Use your observations to help you continue or adjust your instruction. Give each student an opportunity to engage in essential skills activities each day.
- **Plan projects and activities, not just rote practice of basic math facts or endless activity sheets.** Projects help make math come alive, offering an opportunity to see how math concepts connect to building, digging, drawing, deconstructing, imagining, planning, and working together as a team.
- **Use *Essential Math Skills* in combination with other instructional tools** and materials to plan a standards-based curriculum.
- **Develop clear routines for the delivery of mathematics instruction and learning time.** Routines for getting out materials, working together, working independently, checking work, and putting away materials all add to the predictable environment that supports good learning.
- **Take your time.** The standard for proficiency used in *Essential Math Skills* is the

acquisition of deep understanding of the concept or skill as well as the ability to use the skill easily and in many different learning contexts. Learning these skills should be neither a race nor a contest for students. The importance of these skills demands that teachers accept students where they are, provide them with all the time, encouragement, and practice necessary to learn the skills, and systematically monitor their progress in order to move them along to the next level of challenge as soon as they are fully ready.

- **Stand up for the students and speak up for best practice.** In many schools, teachers have been asked to “cover” more math standards than are humanly possible, treat all kids as if they are at the same level of math skills, and “keep up” with the pacing guide. An educational model that encourages a race for grades and that sorts students into winners and losers during the crucial early learning years, is neither effective nor ethical. We can help almost every student develop a deep understanding of the essential math skills.

With less emphasis on racing through content, teachers can identify essential learning outcomes and use ongoing formative assessment to keep track of how each student is progressing toward the skills that matter most. Teachers can help students build every foundational skill to a proficient level, help more students love math, and bring more joy back into our classrooms.

Teach math with love. Teach students with love. Help students fall in love with math!

# Correlation to Standards

Shell Education is committed to producing educational materials that are research- and standards-based. In this effort, we have correlated all of our products to the academic standards of all 50 United States, the District of Columbia, the Department of Defense Dependents Schools, and all Canadian provinces.

## How to Find Standards Correlations

To print a customized correlation report of this product for your state, visit our website at http://www.shelleducation.com and follow the on-screen directions. If you require assistance in printing correlation reports, please contact Customer Service at 1-877-777-3450.

## Purpose and Intent of Standards

Legislation mandates that all states adopt academic standards that identify the skills students will learn in kindergarten through grade twelve. Many states also have standards for Pre-K. This same legislation sets requirements to ensure the standards are detailed and comprehensive.

Standards are designed to focus instruction and guide adoption of curricula. Standards are statements that describe the criteria necessary for students to meet specific academic goals. They define the knowledge, skills, and content students should acquire at each level. Standards are also used to develop standardized tests to evaluate students' academic progress. Teachers are required to demonstrate how their lessons meet state standards. State standards are used in the development of all of our products, so educators can be assured they meet the academic requirements of each state.

## Common Core State Standards

Many lessons in this book are aligned to the Common Core State Standards (CCSS). The standards support the objectives presented throughout the lessons and are provided on the Digital Resource CD (standards.pdf).

## TESOL and WIDA Standards

The lessons in this book promote English language development for English language learners. The standards listed on the Digital Resource CD (standards.pdf) support the language objectives presented throughout the lessons.

## Common Core State Standards

The Essential Math Skills represent the skills that must be learned to a level of deep understanding and application. The Common Core State Standards establish standards for instruction and identify content that should be included in the mathematics curriculum for each grade level. The Essential Math Skills are skills with which proficiency is required to meet those standards.

| Pre-Kindergarten* and Kindergarten | |
|---|---|
| **Standard** | **Skill** |
| **K.CC.1** Count to 100 by ones and by tens. | Skill 1 (pages 23–26); Skill 2 (pages 27–30); Skill 3 (pages 31–33); Skill 5 (pages 39–43); Skill 6 (pages 44–46); Skill 7 (pages 47–50) |
| **K.CC.2** Count forward beginning from a given number within the known sequence (instead of having to begin at 1). | Skill 3 (pages 31–33); Skill 4 (pages 34–36); Skill 7 (pages 47–50) |
| **K.CC.4** Understand the relationship between numbers and quantities; connect counting to cardinality. | Skill 1 (pages 23–26); Skill 2 (pages 27–30); Skill 3 (pages 31–33); Skill 4 (pages 34–36); Skill 6 (pages 44–46); Skill 7 (pages 47–50); Skill 8 (pages 51–53) |
| **K.CC.5** Count to answer "how many?" questions about as many as 20 things arranged in a line, a rectangular array, or a circle, or as many as 10 things in a scattered configuration; given a number from 1–20, count out that many objects. | Skill 1 (pages 23–26); Skill 2 (pages 27–30); Skill 3 (pages 31–33); Skill 4 (pages 34–36); Skill 6 (pages 44–46); Skill 7 (pages 47–50); Skill 8 (pages 51–53) |
| **K.CC.6** Identify whether the number of objects in one group is greater than, less than, or equal to the number of objects in another group (e.g., by using matching and counting strategies). | Skill 3 (pages 31–33); Skill 4 (pages 34–36); Skill 7 (pages 47–50) |
| **K.OA.1** Represent addition and subtraction with objects, fingers, mental images, drawings, sounds (e.g., claps), acting out situations, verbal explanations, expressions, or equations. | Skill 3 (pages 31–33); Skill 4 (pages 34–36); Skill 7 (pages 47–50) |

*The pre-kindergarten skills are aligned to those kindergarten standards for which they begin to build understanding.

| Grade 1 | |
|---|---|
| **Standard** | **Skill** |
| **1.OA.1** Use addition and subtraction | Skill 11 (pages 64–67); Skill 12 (pages |

| | |
|---|---|
| within 20 to solve word problems involving situations of adding to, taking from, putting together, taking apart, and comparing, with unknowns in all positions (e.g., by using objects, drawings, and equations with a symbol for the unknown number to represent the problem). | 68–70) |
| **1.OA.2** Solve word problems that call for addition of three whole numbers whose sum is less than or equal to 20 (e.g., by using objects, drawings, and equations with a symbol for the unknown number to represent the problem). | Skill 11 (pages 64–67); Skill 12 (pages 68–70) |
| **1.OA.3** Apply properties of operations as strategies to add and subtract. | Skill 12 (pages 68–70) |
| **1.OA.4** Understand subtraction as an unknownaddend problem. | Skill 11 (pages 64–67); Skill 12 (pages 68–70) |
| **1.OA.5** Relate counting to addition and subtraction (e.g., by counting on 2 to add 2). | Skill 11 (pages 64–67); Skill 12 (pages 68–70) |
| **1.OA.6** Add and subtract within 20, demonstrating fluency for addition and subtraction within 10. Use strategies such as counting on; making ten; decomposing a number leading to a ten; using the relationship between addition and subtraction; and creating equivalent but easier or known sums. | Skill 11 (pages 64–67); Skill 12 (pages 68–70) |
| **1.OA.8** Determine the unknown whole number in an addition or a subtraction equation relating three whole numbers. | Skill 11 (pages 64–67); Skill 12 (pages 68–70) |
| **1.NBT.1** Count to 120, starting at any number less than 120. In this range, read and write numerals and represent a number of objects with a written numeral. | Skill 9 (pages 57–59); Skill 11 (pages 64–67); Skill 13 (pages 71–73) |
| **1.NBT.2** Understand that the two digits of a twodigit number represent amounts of tens and ones. | Skill 9 (pages 57–59); Skill 13 (pages 71–73) |

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|---|---|
| **1.NBT.4** Add within 100, including adding a twodigit number and a one-digit number, and adding a two-digit number and a multiple of 10, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method and explain the reasoning used. Understand that in adding twodigit numbers, one adds tens and tens, ones and ones; and sometimes it is necessary to compose a ten. | Skill 11 (pages 64–67); Skill 12 (pages 68–70) |

| Grade 2 | |
|---|---|
| **Standard** | **Skill** |
| **2.OA.1** Use addition and subtraction within 100 to solve one- and two-step word problems involving situations of adding to, taking from, putting together, taking apart, and comparing, with unknowns in all positions (e.g., by using drawings and equations with a symbol for the unknown number to represent the problem). | Skill 16 (pages 84–86); Skill 18 (pages 91–93) |
| **2.OA.2** Fluently add and subtract within 20 using mental strategies. By end of Grade 2, know from memory all sums of two one-digit numbers. | Skill 15 (pages 80–83); Skill 16 (pages 84–86) |
| **2.NBT.1** Understand that the three digits of a three-digit number represent amounts of hundreds, tens, and ones (e.g., 706 equals 7 hundreds, 0 tens, and 6 ones). | Skill 19 (pages 94–96) |
| **2.NBT.2** Count within 1,000; skip-count by 5s, 10s, and 100s. | Skill 17 (pages 87–90) |
| **2.NBT.3** Read and write numbers to 1,000 using base-ten numerals, number names, and expanded form. | Skill 19 (pages 94–96) |
| **2.NBT.5** Fluently add and subtract within | Skill 18 (pages 91–93) |

| | |
|---|---|
| 100, using strategies based on place value, properties of operations, and/or the relationship between addition and subtraction. | |
| **2.NBT.6** Add up to four two-digit numbers, using strategies based on place value and properties of operations. | Skill 18 (pages 91–93) |
| **2.NBT.7** Add and subtract within 1,000, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method. Understand that in adding or subtracting three-digit numbers, one adds or subtracts hundreds and hundreds, tens and tens, and ones and ones; and sometimes it is necessary to compose or decompose tens or hundreds. | Skill 18 (pages 91–93) |
| **2.NBT.8** Mentally add 10 or 100 to a given number 100–900, and mentally subtract 10 or 100 from a given number 100–900. | Skill 18 (pages 91–93) |

| Grade 3 | |
|---|---|
| **Standard** | **Skill** |
| **3.OA.1** Interpret products of whole numbers, e.g., interpret 5 × 7 as the total number of objects in 5 groups of 7 objects each. | Skill 27 (pages 124–126) |
| **3.OA.8** Solve two-step word problems using the four operations. Represent these problems using equations with a letter standing for the unknown quantity. Assess the reasonableness of answers using mental computation and estimation strategies, including rounding. | Skill 29 (pages 131–134) |
| **3.NBT.1** Use place value understanding to round whole numbers to the nearest 10 or 100. | Skill 23 (pages 111–112); Skill 24 (pages 113–114) |

| | |
|---|---|
| **3.NBT.2** Fluently add and subtract within 1,000, using strategies and algorithms based on place value, properties of operations, and/or the relationship between addition and subtraction. | Skill 20 (pages 99–101); Skill 22 (pages 107–110); Skill 25 (pages 115–117) |
| **3.NF.1** Understand a fraction 1/b as the quantity formed by 1 part when a whole is partitioned into *b* equal parts; understand a fraction *a/b* as the quantity formed by a parts of size *1/b.* | Skill 28 (pages 127–130) |
| **3.MD.1** Tell and write time to the nearest minute and measure time intervals in minutes. Solve word problems involving addition and subtraction of time intervals in minutes (e.g., by representing the problem on a number-line diagram). | Skill 21 (pages 102–106) |
| **3.MD.6** Measure areas by counting unit squares (square cm, square m, square in., square ft., and improvised units). | Skill 21 (pages 102–106) |
| **3.G.2** Partition shapes into parts with equal areas. Express the area of each part as a unit fraction of the whole. | Skill 28 (pages 127–130) |

# About the Author

Photo Credit: Lynn Gregg

Bob Sornson, Ph. D., is nationally recognized for developing the Early Learning Success Initiative and works with schools and community organizations across the country to support teachers and parents. Dr. Sornson is dedicated to giving every child the opportunity to achieve early learning success, which lays the foundation for success in life. Bob is the author of *Stand Up and Speak Up For Yourself and Others, Stand in My Shoes: Kids Learning about Empathy, The Juice Box Bully, Fanatically Formative During the Crucial K–3 Years, Creating Classrooms Where Teachers Love to Teach, The Pre-K to Grade 3 Essential Skill Inventories,* and many other publications.

Dr. Sornson is a leader of and advocate for programs and practices that support early learning success, high-quality early childhood learning programs, and parent engagement. His workshops and keynote presentations are known for his storytelling, humor, and interactive style.

# Skills and Activities

## for Proficiency in

# Pre-Kindergarten

The pre-kindergarten math skills should be learned to proficiency, a level of deep understanding that allows a student to use the skill in multiple contexts and in new situations. These four skills are not intended to be a comprehensive curriculum or an instructional program. Math learning experiences in pre-kindergarten should include numerals, measuring, balancing, movement, building, prediction, and activities and projects that bring math to life. Use rich mathematics vocabulary while engaging students in these activities (see *Math Vocabulary*, page 166). The essential skills provide a guide to a small set of skills that are indispensable, developing a basic foundation that allows students to proceed to higher levels of mathematics.

## Recommended Materials

- Vinyl non-skid spots
- Beanbags
- Abacus
- Ball
- Buttons
- Hot glue
- Index cards
- Number cubes
- Counters
- Paper cups
- Manipulatives
- Letter tiles
- Blocks
- Plastic containers
- Erasers
- Puzzle pieces
- String

- Pencils
- Ribbons
- Calendar
- Stickers
- Interlocking cubes
- Pen tops
- Old keys
- Two containers
- Marbles
- Crackers, two different types
- Pictures of animals
- Dish
- Cardboard rectangle
- Tape or chalk *(optional)*

## Essential Math Skills

**Skill 1:** Demonstrates one-toone correspondence for numbers 1–10, with steps

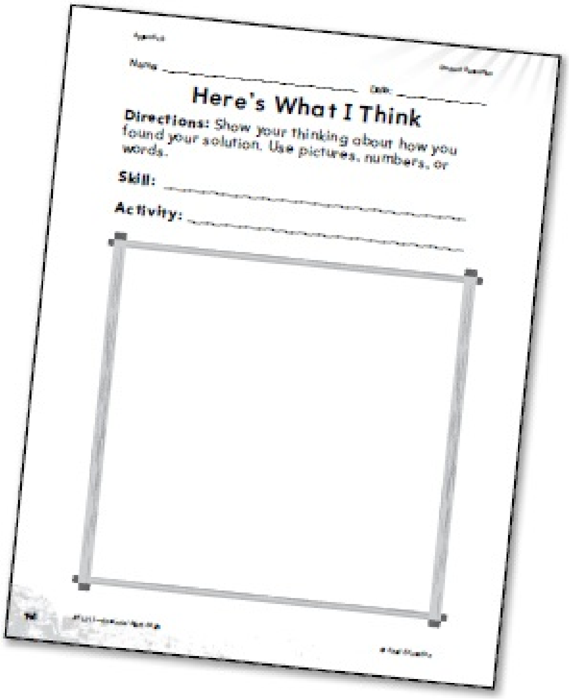
**Skill 2:** Demonstrates one-toone correspondence for numbers 1–10, with manipulatives

**Skill 3:** Adds on, using numbers 1–10, with steps

**Skill 4:** Adds on, using numbers 1–10, with manipulatives

## Additional Resources

- *Here's What I Think* (page 148; whatthink.pdf) *(optional)*



Name ______________ Date: ______________

Here's What I Think

**Directions:** Show your thinking about how you found your solution. Use pictures, numbers, or words.

**Skill:** ______________

**Activity:** ______________

Pre-Kindergarten Skills

**Skill 1**

# Demonstrates one-to-one correspondence for numbers 1–10, with steps

## Skill Progression

Proficiency for this skill is demonstrated by the student's ability to count out loud and correctly step to the chosen number with 100 percent accuracy for each of 10 attempts on three or more days, using three or more different activities. While not all the following activities involve stepping, they do focus on gross-motor skills similar to taking steps.

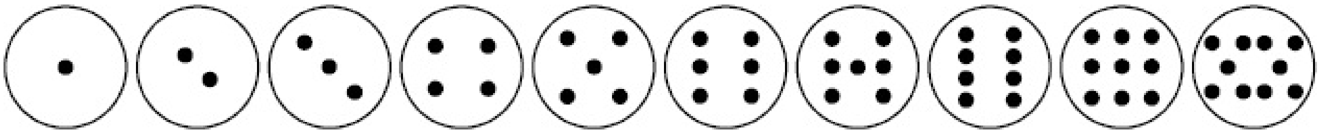
| Emerging | Developing | Proficient |
|---|---|---|
| Not yet able to count steps in sequence | Able to count 2 to 9 steps in sequence, but is inconsistent | Counts 10 or more steps in sequence |

## Activities for Skill Development and Assessment

### Walk the Line

Place 10 vinyl non-skid spots in a line on the floor. Use a marker or stickers to add 1–10 dots to each spot. Place the spots on the ground, in order. Ask the student to stand on the starting spot. Choose a number between 1 and 10, and model taking that number of forward steps on the spots. Then, ask the student to take any number (1–10) of forward steps, stepping on the next group of dots with each step. For example, say, "Take four steps forward." As the student steps, have him or her count out loud. Practice 5–10 times per day. Give positive feedback each time the student performs the activity. For example, "Great job. You stopped on the four dots! Now, go back to the start. Try six steps forward." Allow the student to notice the pattern of dots on the floor without much explanation from you. Celebrate successes.

***Teacher Tip:*** A number line can be made on the floor with tape, drawn with chalk on concrete or asphalt, or painted on non-skid carpet squares.



### Stepping Stones

Place 10 vinyl non-skid spots on the floor as "stepping stones" (not in a straight line). Say, "Take ______ steps forward." Practice 5–10 repetitions of this activity in a session, with great enthusiasm for each performance. For example, say, "Great job. You are standing on the five dots. Now, go back to start. Ready? Now count and step to eight."

Vary the difficulty by your placement of the stepping stones. Stretching, crossing midline, and varying distances between "stones" will help the student internalize the sequence and value of numbers. Students also have to actively look for the next stepping stone to determine where to step.

## Go the Distance

Identify a destination (e. g., a blue chair, a door) and instruct the student to count aloud his or her steps from a starting point to the destination. Begin with easy missions. For example, "Count aloud your steps from here to the door." Use short distances of 10 steps or fewer. Repeat the activity 5–10 times in a session so that the student can feel the difference between varying distances.

**Variation:** Ask the student to count sideward steps or backward steps to reach a destination. Changing the direction of the steps makes the activity seem like a new challenge and keeps students engaged.

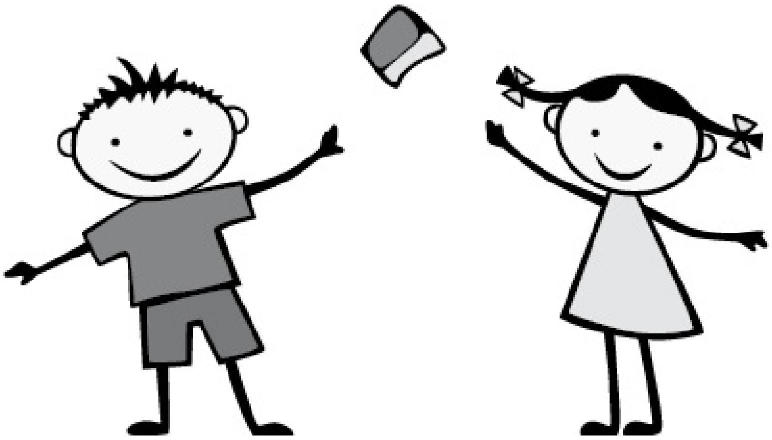
## Ups and Downs

Practice counting steps on a stairway. Standing at the bottom of the stairs, throw a beanbag partway up the flight of stairs. Ask the student to count the steps as he or she goes to retrieve the beanbag. Repeat the activity 5–10 times in a session so that the student can feel the difference between varying numbers of steps.

# Activities to Extend Deep Understanding

## Catch

Ask the student to stand and catch a certain number of beanbags. Make this activity fun and easy by throwing the beanbags gently, underhand, directly toward the student's chest. Encourage the student to catch with two hands and then drop the beanbag. When he or she has caught the correct number of beanbags, the student should say *stop.* Some students will count aloud, while others will count silently before saying *stop*. Repeat this activity 5–10 times in a session.



**Variation:** Catch and Hold—Have the student catch and hold the beanbags until he or she is holding the correct number.

## Throw

Ask the student to throw a certain number of beanbags into a crate or toward a target. Have the student count only the beanbags that land in the target. Celebrate successes! Repeat this activity 5–10 times in a session.

## Imitation

At the beginning of a whole-group activity, ask students to repeat a movement that you make a certain number of times. You might nod your head three times and ask the students to nod three times.

## Follow Me

Swing your arms as you step and count out loud, having students follow and count with you. Stop walking at various numbers. Pause, and then start the process over again, beginning with *one*.

## Estimation

Show students how to carefully toss a beanbag underhand, guess the distance to it in steps, and then count the steps it takes to get to the beanbag. Give a student a beanbag. Ask him or her to toss it, guess the distance to it in steps, and then count the actual number of steps.

## On Tour

Take a tour around the school. Stop at various places, and ask students to guess how many steps it will take to reach a specific destination such as a stairway, a fire extinguisher, an office door, or a display case. Then, test the students' estimates.

## Setting Up

When putting out carpet squares or chairs, ask students to stand beside them and count students and the seats, emphasizing one seat for one student.


STOP
SCHOOL

Pre-Kindergarten Skills

**Skill 2**

# Demonstrates one-to-one correspondence for numbers 1–10, with manipulatives

## Skill Progression

Proficiency for this skill is demonstrated by the student's ability to count objects out loud correctly to the chosen number with 100 percent accuracy for each of 10 attempts on three or more days, using three or more different activities. The activities provided for this skill focus on fine-motor skills.

| Emerging | Developing | Proficient |
|---|---|---|
| Not yet counting objects with one-to-one correspondence | Counts objects with accuracy to 3 | Shows one-to-one correspondence when counting 10 or more objects |

## Activities for Skill Development and Assessment

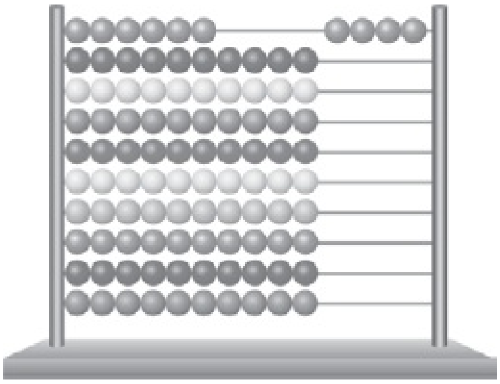
### Touch and Count

Put several small objects (e.g., marbles, buttons, small stones, pencils, clothespins) into a dish. Ask the student to count aloud while moving the objects from one dish to another. This exercise supports the relationship between numerals and quantity and provides visual, auditory, and kinesthetic experiences. Repeat this activity 5–10 times in a daily session.

**Variation:** Have the student estimate before counting, and then count and move the objects.

### Absolutely Abacus: How Many?

Place the abacus in front of the student. Using the top row of beads, move a certain number of beads to one side. Ask, "How many is this?" Allow the student to count the beads aloud, one by one. Use numbers that allow the student to quickly find success at least 95 percent of the time. Repeat this activity 5–10 times in a daily session.



## Toss Up

Ask the student to toss a ball or a beanbag up in the air up to 10 times, counting with each catch. Keep it fun and successful.

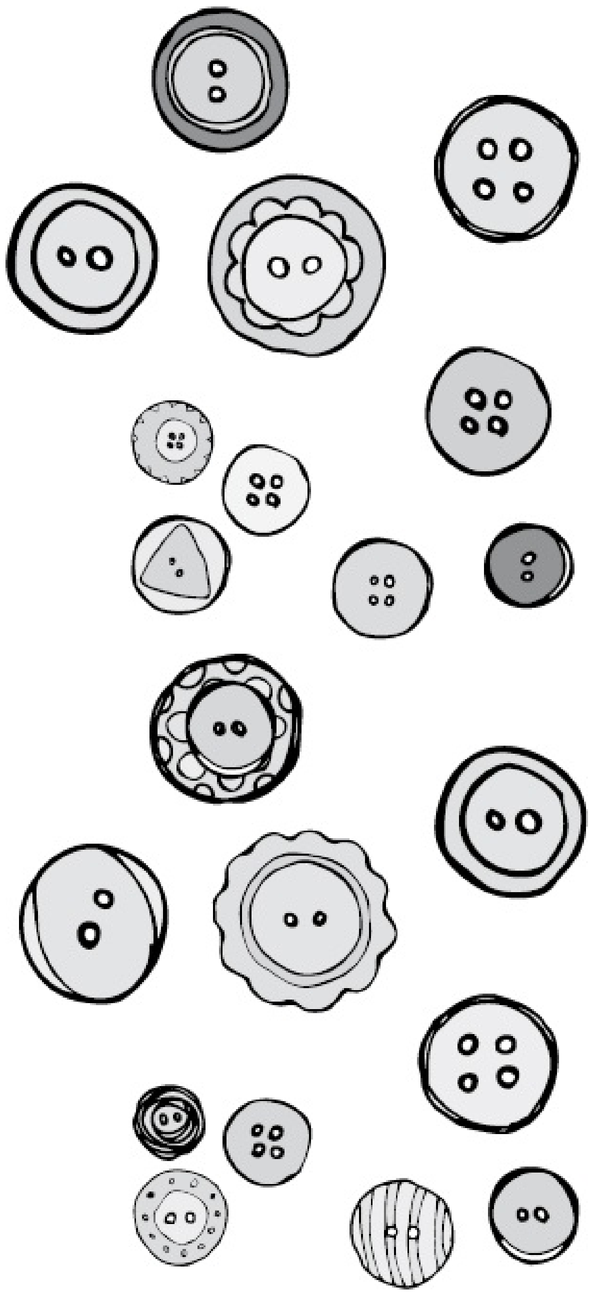
## Button Cards

Use hot glue to attach buttons to index cards. Create cards with varying numbers of buttons, up to 10. Flash a card and ask the student to estimate how many buttons are on the card. After the student has estimated, allow him or her to count the buttons to check the estimate.

## Fill the Cup

Give the student a number cube and 10 counters. Tell him or her to roll the number cube and count the number rolled. Then, have the student count out that number of counters and put them into a paper cup.

**Variation:** Use different manipulatives (e.g., interlocking cubes, pasta, beans) to keep the activity interesting for the student.



## Counting Letters

Using letter tiles, help the student to spell his or her first name. Ask the student to count the letters. Continue spelling out other names, such as those of siblings, parents, classmates, or pets, and ask the student to count the letters in each name.

## Junk in the Trunk

Collect items from around the classroom (e.g., erasers, crayons, blocks, puzzle pieces) and put them into a plastic container. Plan to collect one button, two blocks, three erasers, four puzzle pieces, five paper clips, six bits of string, seven pencils, eight ribbons, nine pen tops, 10 old keys, or any similar combination. Ask the student to sort the items into piles of the same items, and then count how many are in each pile.

## Tapping Out

Model counting while tapping on your leg up to 10 times. Then, ask the student to copy your pattern. Sitting across from the student, model a simple one-leg counting pattern (e. g., tapping with one hand on one leg while counting out loud). Vary rhythm and complexity as long as the student is having fun and is successful at least 95 percent of the time. Introduce two-handed patterns (up to 10) when the student is ready.

## Activities to Extend Deep Understanding

## Block Measurement

Give the student a supply of identical objects (e.g., chenille stems, unused erasers, drinking straws, blocks). Ask him or her to guess and then measure how many objects it will take to cover the distance from one point to another (e.g., from one end of a desk to the other, across the cover of a big book, or from one side of a doorjamb to the other). Model how to accurately measure by properly lining up the objects. Have the student count each object he or she has used to measure.

## Fill It Up

Ask the student how many beanbags (or blocks, erasers, pencils, action figures, etc.) he or she thinks will fit into a small box or bag, and then ask him or her to fill the container to capacity and count the total number of objects.

## Snack-Time Counting

Ask the student to count the number of students at a table. Then, have him or her count out the number of snacks needed so that each student gets one.

## Calendar Counting

Use a calendar to count days. Point to and count all the days in one week, the school days left in the week, or the number of Saturdays in the month.


## Number and Value

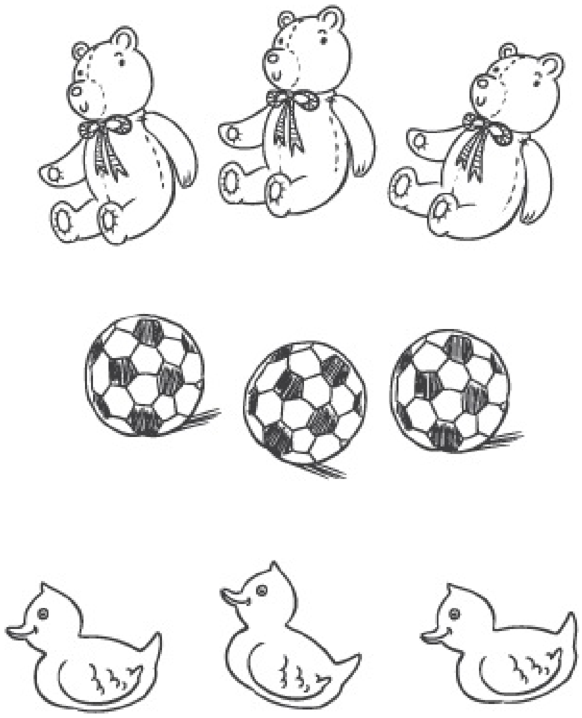
Arrange a row of 3–5 stickers. Arrange a second row with the same number of stickers but with more space between each sticker. Ask the student whether the number of stickers in each row is the same or whether there are more or fewer. Ask the student how he or she can find out, and then allow the student to figure out how to count and compare the two rows of stickers.

## Matched Sets

Create a group of 2–10 familiar objects, such as stuffed bears, baseballs, or beanbags. Using a different familiar object, ask the student to create a new set with the same number of objects as the first set.

## Value to Value

Build a connected set of 3–5 interlocking cubes. Ask the student to guess how many individual cubes it will take to build another set of the same size. After the student's guess, allow him or her to test the estimate by building a new set.



Pre-Kindergarten Skills

# Skill 3

# Adds on, using numbers 1–10, with steps

## Skill Progression

Proficiency for this skill is demonstrated by the student's ability to take the correct number of steps and then add on steps correctly and identify the final number value with 100 percent accuracy for each of 10 attempts, on three or more days, using two or more different activities. The activities provided allow the student to learn the value (through distance) of a number and learn to compare the value of numbers physically and mentally.

| Emerging | Developing | Proficient |
|---|---|---|
| Unable to add on numbers using steps on a number line without recounting (1–10) | Inconsistently adds on numbers using steps on a number line without recounting (1–10) | Adds on numbers using steps on a number line without recounting (1–10) |

## Activities for Skill Development and Assessment

### Walk On

Use vinyl spots, tape, or chalk to create a number line on the floor. Ask the student to move to a certain number, stepping on each number along the way. Once there, ask the student to take a certain number of additional steps and then ask which number he or she is standing on. For example, "Step to five. Great job! Now, take three more steps. Which number are you standing on?" The student should give you the number value of the spot on which he or she is standing.

**Variation:** Use numerals rather than dots on the number line. This helps the student identify numerals and use them to represent a number value. The student will tell you when this activity gets too easy.

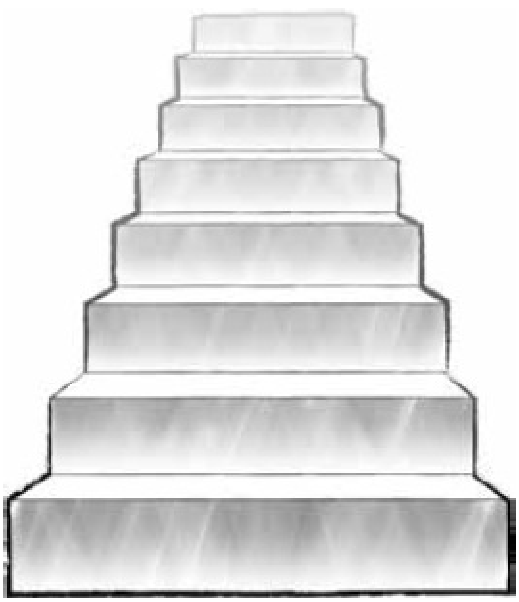
## Estimation for Education

Ask the student to walk to a destination within the room, counting the steps to get there. Choose a destination 6–10 steps away. Then, direct the student to walk partway back and stop. Don't ask the student to count steps during this phase of the activity; see whether he or she does it independently. Now, ask the student to estimate how many steps it will take to get to the original location. After the student estimates, ask him or her to walk back and check the estimation. Show enthusiasm when the student makes a good estimate.

## Continue the Climb

Using a stairway, ask the student to count the steps from bottom to top. Ask the student to take a certain number of steps up the stairs. Then, ask him or her to proceed a certain number of additional steps and identify where he or she stands.

***Teacher Tip:*** Label the steps with vinyl spots marked with dots (see page 23) to make the activity easier initially.



## Horizontal Ladder

If the school playground has a play structure with a horizontal ladder, ask the student to count the bars from one end to the other. Ask the student to swing to a certain bar, for example, the fourth bar. Then, ask him or her to swing forward a certain number of bars and identify the value of the bar from which he or she is hanging. Arm strength is required for this activity; carefully spot the student.

## Everglades Trek

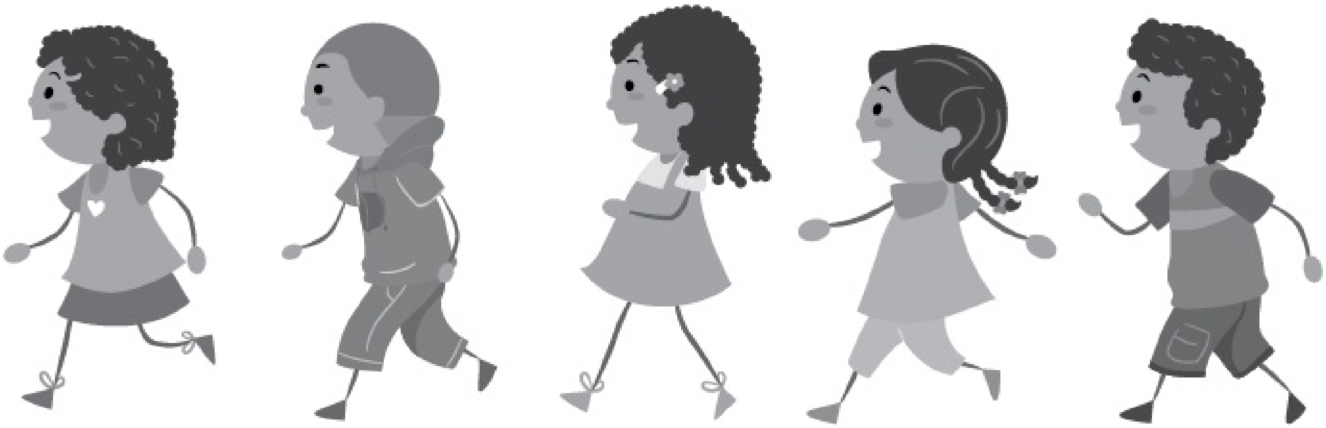
Ask the student to pretend the playground is the Everglades, teeming with alligators. Place vinyl spots marked with dots (see page 23) on the ground as “safety spots,” just far enough apart so that the student must stretch to reach each one. Ask the student to move to a certain number, stepping on each number along the way. Once there, ask the student to take additional steps forward, and then ask, “Where are you now?” The student will give you the number value of the spot on which he or she is standing.

## Walk Back *(Challenge Activity)*

Using a number line (created with dots, not numerals), direct the student to take a certain number of steps forward. Then, have him or her take a certain number of steps backward. Ask, “Where are you now?”

While this activity is easy for many students, continue to practice 5 repetitions per day for at least 20 days. Although you are teaching the concept of subtraction, never describe that concept to the student. Allow the student to enjoy the confidence with which he or she can be successful and to develop a kinesthetic awareness of moving from a larger number to a smaller number by stepping backwards.

**Variation:** After the student seems to understand all the number values, use numerals rather than dots on the number line. This helps the student to symbolically represent a number value.



Pre-Kindergarten Skills

**Skill 4**

# Adds on, using numbers 1–10, with manipulates

## Skill Progression

Proficiency for this skill is demonstrated by the student's ability to count the correct number of objects, then add on correctly and identify the final number value with 100 percent accuracy for each of 10 attempts on three or more days, using three or more different activities.

| Emerging | Developing | Proficient |
|---|---|---|
| Unable to add on numbers without recounting (1–10) | Inconsistently adds on from a set of objects without recounting (1–10) | Adds on from a set of objects without recounting (1–10) |

## Activities for Skill Development and Assessment

### Absolutely Abacus: Show Me

Give the student an abacus or a counting frame and have him or her show you a certain number of beads on the first row. Allow plenty of time for the student to move the beads, as many young students may have trouble at first. Then, tell him or her to add a certain number more to that group. Ask the student how many beads there are now altogether. Play with adding on within the row of 10 beads. For example, you might say, "Show me five beads. Good job. Now, add on two more. How many are there now?"

### Summation

Show the student two containers, each filled with a single color of marbles (e.g., one container of blue marbles and one container of yellow marbles). Ask the student to pick a certain number of marbles from each container. Then, ask him or her to determine how many total marbles he or she has. Give the students problems that can be solved within about 10 seconds.

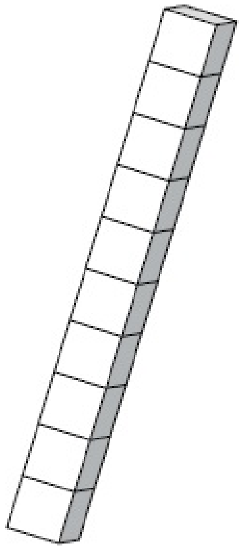
**Variation:** Replace the marbles with plastic chips, interlocking cubes, or other small objects in order to keep the activity engaging.

### Snack Attack

At snack time, lay out a certain number of one type of cracker (e. g., square crackers), and ask the student to count the crackers. Then, display a certain number of a different type of cracker (e. g., round crackers), and have the student add on. Ask how many crackers there are altogether.

## Interlocking Cubes

Ask the student to put together a certain number of interlocking cubes. Then, ask him or her to add a certain number more to that group. Ask the student how many cubes there are now altogether. Play with adding on within a total of 10. For example, “Put together four cubes. Good job. Now, add on two more. How many are there now?”



## Button Up

Show the student a button card with up to 5 buttons on it. Ask the student to count the buttons. Then, show another button card and encourage the student to add on. Ask the student to determine the total number of buttons.

## Loads of Legs

Gather a collection of pictures of creatures that have different numbers of legs (e.g., people, dogs, spiders, insects.) Have the student choose one picture and tell you how many legs the creature has (he or she can count the legs if necessary). Then, have the student choose another picture and again tell you how many legs he or she sees. Finally, ask the student to tell you how many legs there are altogether in the two pictures. Continue the activity with two new pictures.

## Junk in a Jar

Give a student a clean plastic jar and 10 marbles (or use blocks, buttons, beads, bells, etc.). Tell the student to place a specific number of marbles (1–10) into his or her jar. Next, ask the student how many marbles would be in the jar if a certain number more were added. After the student adds these marbles, check the sum.

## Conservation of Number Value *(Challenge Activity)*

Place a set of objects (e.g., buttons, beads, marbles, blocks, crayons, pencils) in your hands. Have the student count the number of objects in your hands. Add 1–3 more objects to the set in your hands. Allow the student to observe and understand how many were added to the group without letting him or her see the new group. Then, ask the student to tell you how many are now in your hands.

Place a set of objects on a dish. Cover the dish with a piece of cardboard to screen the student's view of the objects. Add 1–3 objects, allowing the student to clearly see how many were added or taken away but not letting him or her see the new set. Again, ask the student to tell you how many are now in the group. Try the same activity using objects in a hat, in a shoe box, in a cupboard, or under a blanket.

***Teacher Tip:*** Do not exceed 10 objects in a set for this activity. Use number values that allow each student to experience great success with this activity. Be cautious not to make it too difficult.