

The Pre-K to Grade 3 Essential Math Skills Inventory

Developing Deep Understanding of Basic Mathematical Concepts

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The Pre-K to Grade 3 Essential Math Skills Inventory helps you systematically measure the development of crucial basic math skills, and then respond by giving children learning activities at a level where they can be challenged and still highly successful. It is designed for use with children ages 3 to 9, during the preschool to grade three years, because this is the period in which children have the greatest opportunity to deeply understand and fall in love with math.

Properly using this simple inventory encourages teachers and parents to know exactly which skills kids have developed to a level of deep understanding and application, and which skills still need instruction, practice, activities, projects and/or play. By carefully tracking progress toward essential math skills, we can help almost every child deeply understand the fundamentals of math and vastly increase the number of children who use it joyfully throughout their lives.

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

Early childhood is the crucial time during which we build the foundation skills, behaviors, and beliefs which establish our path as a learner for life. Sadly, for many young children 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% of American children are at proficient math levels. By eighth grade this has decreased to 35% student proficiency, and by twelfth grade only 26% of students remaining in school performed at or above the proficient level in mathematics (NAEP, 2011, 2009).

The long-term effects of such numbers of American children becoming non-proficient math learners in the information age are a calamity. 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 for advanced education, better decisions about risky behaviors, decreased criminality, stable relationships and success on the job. The costs of letting three-quarters of our children become non-proficient in math include diminished employment option for our children and reduced prosperity for our society.

It is time for us to help more of our children develop the numeracy skills that will allow them to succeed in the information economy. *The Pre-K to Grade 3 Essential Math Skills Inventory* supports teachers and parents as we stop racing through math instruction, and take the time to learn the essential outcomes well. This idea is not new.

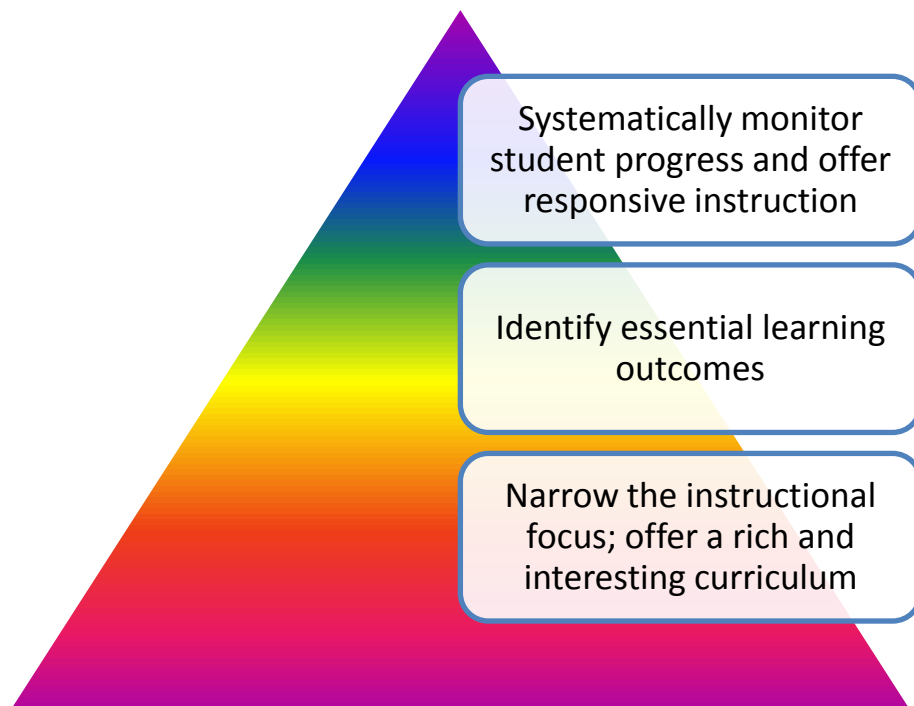
The National Council of Teachers of Mathematics recommends that math curriculum should include fewer topics, spending enough time to make sure each is learned in enough depth that it need not be revisited in later grades. That is the approach used in most top-performing nations.

- National Mathematics Advisory Panel, 2008

During the early years of math learning children should be engaged in a rich and interesting set of math learning experiences which include manipulatives, projects, and activities. Much of this early learning should seem like exploration, inquiry, and play. At school teachers are advised to use a math curriculum based on the Common Core State Standards, or on a set of outcomes developed by your state, that serve as a guide for content to cover during the year. But “covering” crucial content is not enough. Some skills need more than coverage. They need high quality instruction, and for some children these skills require re-teaching, more time for practice, different approaches to learning, and more time for activities which help these skills become deeply understood and easy to use in life.

Some math skills are essential to understanding numbers and how they work. These are the skills which might be considered the “core of the core.” They must be well understood or a child will be forever compromised as she moves forward into more complex math learning.

The Pre-K to Grade 3 Essential Math Skills Inventory helps you systematically measure what matters most: student learning. It can be used along with any thoughtful math curriculum or learning materials. It allows you to keep track of the skills that have been well-learned, plan instruction for the skills your child is ready to learn, allow all the time needed to help her develop deep understanding, and move her forward as soon as she is ready for the next level of skill. During the crucial early years, we can ensure that student learning needs drive instruction rather than a non-viable curriculum or pacing guide.



With less emphasis on racing through content, we 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. We can help children build every foundation skill to a proficient level, help more students love math, and bring more joy back into our classrooms.

The Pre-K to Grade 3 Essential Math Skills Inventory

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- (Pre-K) Demonstrates one-to-one correspondence for numbers 1-10, with steps
- (Pre-K) Demonstrates one-to-one correspondence for numbers 1-10, with manipulatives
- (Pre-K) Adds on/takes away using numbers 1-10, with steps
- (Pre-K) Adds on/takes away using numbers 1-10, with manipulatives
- (K) Demonstrates counting to 100
- (K) Has one-to-one correspondence for numbers 1-30
- (K) Understands combinations (to 10)
- (K) Recognizes number groups without counting (2-10)
- (1) Understands concepts of add on or take away (to 30)
- (1) Adds/subtracts single digit problems on paper
- (1) Counts objects with accuracy to 100
- (1) Replicates visual or movement patterns
- (1) Shows a group of objects by number (to 100)
- (2) Quickly recognizes number groups (to 100)
- (2) Adds/subtracts from a group of objects (to 100)
- (2) Adds/subtracts double digit problems on paper
- (2) Counts by 2, 3, 4, 5, and 10 using manipulatives
- (2) Solves written and oral story problems using the correct operations
- (2) Understands/identifies place value to 1,000
- (3) Reads and writes numbers to 10,000 in words and numerals
- (3) Uses common units of measurement:
 - Length
 - Weight
 - Time
 - Money
 - Temperature
- (3) Can add or subtract three digit problems on paper with regrouping
- (3) Can round numbers to the 10s
- (3) Can round numbers to the 100s
- (3) Add and subtract 2 digit numbers mentally
- (3) Counts by 5,6,7,8,9,10 using manipulatives
- (3) Uses arrays to visually depict multiplication
- (3) Recognizes basic fractions
- (3) Solves written and oral story problems using the correct operation

The Pre-K to Grade 3 Essential Math Skills Inventory

Student: _____ Teacher: _____ Date: _____

| Skill | Not Yet | Intervention | Developing | Proficient |
|---|---------|--------------|------------|------------|
| Demonstrates one-to-one correspondence for numbers 1-10, with steps | | | | |
| Demonstrates one-to-one correspondence for numbers 1-10, with manipulatives | | | | |
| Adds on using numbers 1-10, with steps | | | | |
| Adds on using numbers 1-10, with manipulatives | | | | |
| Demonstrates counting to 100 | | | | |
| Has one-to-one correspondence for numbers 1-30 | | | | |
| Understands combinations (to 10) | | | | |
| Recognizes number groups without counting (2-10) | | | | |
| Understands concepts of add on or take away (to 30) | | | | |
| Adds/subtracts single digit problems on paper | | | | |
| Counts objects with accuracy to 100 | | | | |
| Replicates visual or movement patterns | | | | |
| Shows a group of objects by number (to 100) | | | | |
| Quickly recognizes number groups (to 100) | | | | |
| Adds/subtracts from a group of objects (to 100) | | | | |
| Adds/subtracts double digit problems on paper | | | | |
| Counts by 2, 3, 4, 5, and 10 using manipulatives | | | | |
| Solves written and oral story problems using the correct operations | | | | |
| Understands/identifies place value to 1,000 | | | | |
| Reads and writes numbers to 10,000 in words and numerals | | | | |
| Uses common units of measurement: | | | | |
| • Length | | | | |
| • Weight | | | | |
| • Time | | | | |
| • Money | | | | |
| • Temperature | | | | |
| Can add or subtract three digit problems on paper with regrouping | | | | |
| Can round numbers to the 10s | | | | |
| Can round numbers to the 100s | | | | |
| Add and subtract 2 digit numbers mentally | | | | |
| Counts by 5,6,7,8,9,10 using manipulatives | | | | |
| Uses arrays to visually depict multiplication | | | | |
| Recognizes basic fractions | | | | |
| Solves written and oral story problems using the correct operation | | | | |

Protocol for Use of the *Individual Essential Math Skill Inventory*

The Essential Math Skills Inventory is a simple format for systematically assessing the most crucial skills in the development of early numeracy. The inventory serves as an on-going formative assessment tool, regularly updated by the teacher/parent, so you can identify specifically what students know and what they are ready to learn. These skills are the core of the core (CCSS), and cannot be merely “covered”. These are the skills we must ensure students learn to a level of deep understanding and application. These are the foundation skills upon which a lifetime of successful mathematical learning will be built.

1. During the first few weeks of school, use observational, informal and instructional assessment to get to know which skills your student/child has, and which skills are lagging in development.
2. Note proficiency **by writing the date** on the inventory. Student proficiency is noted only after the student has demonstrated this skill at the proficient level on several occasions and using more than one type of instructional material. Be certain that a student deeply understands and can use a skill before certifying proficiency.
3. You may wish to devise a system to remind you of the times when proficient skills were noticed. Some teachers use dots (in pencil) on the inventory to note these observations.
4. Exceptions can be made to the rule of several observations during baseline data collection, but only when teachers/parents use careful observational assessments and are certain a skill is completely proficient.
5. Plan instruction based on this information. Your knowledge regarding which skills this student already has and which ones are developing will help you pick activities and projects which match the child’s readiness.
6. Update your Essential Math Skills Inventory weekly as you see the students move from **Intervention** to **Developing** to **Proficient**. Celebrate success.

Essential Math Skills Inventory: Rubric

| Preschool | Emergent | Developing | Proficient |
|---|---|---|--|
| Demonstrates one-to-one correspondence for numbers 1-10, with steps | Not yet able to count steps in sequence | Able to count 2 to 9 steps in sequence, but is sometimes inconsistent | Counts 10 or more steps in sequence |
| Demonstrates one-to-one correspondence for numbers 1-10, with manipulatives. | 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 |
| Adds on using numbers 1-10, with steps | 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) |
| Adds on using numbers 1-10, with manipulatives | 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) |
| Kindergarten | Intervention | Developing | Proficient |
| Demonstrates counting to 100 | Counts to less than 20 with accuracy | Able to count to 50 to 99 with accuracy | Counts to 100 with accuracy |
| Has one-to-one correspondence for numbers 1 to 30 | Can count fewer than 10 objects with one-to-one correspondence | Shows one-to-one correspondence when counting 10 to 29 objects | Shows one-to-one correspondence when counting 30 or more objects |

| | | | |
|---|--|--|--|
| Understands combination (to 10) | Does not consistently understand how to add on or take away 1-3 objects without recounting | Consistently adds on or takes away 1-3 objects without recounting | Adds on or takes-away from a set of objects without recounting (1-10) |
| Recognizes number groups without counting (2 to 10) | Recognizes number groups of 1 or 2 without counting | Recognizes number groups of 3 to 5 without counting | Recognizes number groups up to 10 without counting individual objects |
| First Grade | Intervention | Developing | Proficient |
| Counts objects with accuracy to 100 | Counts fewer than 20 objects with accuracy | Sometimes counts objects with accuracy (to 100) | Consistently counts objects with accuracy (to 100) |
| Replicates visual patterns or movement patterns | Has difficulty replicating a 2-step visual pattern (i.e. square-circle, red-blue) or a 2-step movement pattern (i.e. clap hands, step forward) | Can sometimes replicate a 2- or 3-step visual or movement pattern | Can consistently replicate a 3- or 4-step visual pattern or movement pattern |
| Understands concepts of add on or take away (to 30) with manipulates | Unable to add on or take away numbers from a group (to 10) | Using an abacus (or other standard counting manipulative), can add on or take away numbers from group, but must recount to find resulting number (to 30) | Using an abacus (or other standard counting manipulative), can add on or take away numbers and name resulting number (to 30) |

| | | | |
|---|---|--|---|
| Can add or subtract single digit problems on paper | Needs assistance to add single digit problems on paper | Adds single digit problems on paper independently but with partial accuracy | Adds single digit problems on paper independently and accurately |
| Show a group of objects by number (to 100) | Shows a group of objects of fewer than 25 using an abacus or other manipulative | Shows a group of objects to 50 using an abacus or other manipulative | Shows a group of objects to 100 using an abacus or other manipulative |
| Second Grade | Intervention | Developing | Proficient |
| Quickly recognizes number groups (to 100) | Using manipulatives, recognizes numbers groups of fewer than 25 | Using manipulatives, recognizes number groups of 25 to 75 | Using manipulatives, quickly recognizes number groups to 100 |
| Adds or subtracts from a group of objects (to 100) | Needs assistance to add to a group of objects and recognize the sum | Can accurately add to a group of objects but needs assistance with subtraction | Can accurately add to or subtract from a group of objects to 100 |
| Adds or subtracts double-digit problems on paper | Needs assistance to add double-digit problems on paper | Accurately adds double-digit problems on paper but needs assistance with subtraction | Accurately adds or subtracts double-digit problems on paper |
| Counts by 2, 3, 4, 5, and 10 using manipulatives | Unable to skip count using manipulatives | Counts by 2s and 5s and is beginning to count by 3s and fours using manipulatives | Consistently counts by 2s, 3s, 4s, 5, and 10s using manipulatives |

| | | | |
|---|---|---|---|
| Solves written and oral story problems using the correct operations | Unable to solve written and oral story problems with guidance | Able to solve written and oral story problems with guidance | Consistently able to solve written and oral story problems by developing a plan, solving problems using correct operations, and evaluating the solution |
| Understand/identifies place value to 1,000 | Does not yet understand place value for 1s, 10s, 100s and 1000s | Consistently identifies place value for 1s and 10s. Sometimes identifies place value for 100s and/ or 1000s | Consistently understands and identifies place value for 1s, 10s, 100s, and 1000s |
| Third Grade | Intervention | Developing | Proficient |
| Reads and writes numbers to 10,000 in words and numerals | Counts, reads, and/or writes numbers to 100 | Counts, reads, and/or writes numbers to 1,000 | Counts, reads, and writes numbers to 10,000 |
| Uses common units of measurement: length, weight, time, money, temperature | Does not yet use units of measurement accurately | Able to use some units of measurement with accuracy | Consistently able to use all common units of measurement accurately |
| Adds or subtracts 3-digit problems on paper with regrouping | Unable to add or subtract 3 digit numbers with regrouping | Able to accurately add or subtract 3-digit numbers with guidance or use of manipulatives | Able to accurately add or subtract 3-digit numbers on paper |
| Rounds numbers to the 10s | Unable to round numbers to 10s | Rounds numbers to 10s in somewhat consistent manner | Automatically rounds numbers to 10s |

| | | | |
|---|---|---|--|
| Rounds numbers to the 100s | Unable to round numbers to 100s | Rounds numbers to 100s in somewhat consistent manner | Automatically rounds numbers to 100s |
| Adds and subtracts 2-digit numbers mentally | Unable to mentally add or subtract 2-digit numbers | Sometimes able to demonstrate ability to mentally add or subtract 2-digit numbers | Consistently demonstrates ability to mentally add or subtract 2-digit numbers |
| Counts by 5, 6, 7, 8, 9, and 10 using manipulatives | Unable to skip count using manipulatives | Beginning to count by 5, 6, 7, 8, 9, and 10 using manipulatives | Consistently counts by 5, 6, 7, 8, 9, and 10 using manipulatives |
| Uses arrays to visually depict multiplication | Uses arrays to visually depict multiplication for facts through 2 | Uses arrays to visually depict multiplication for facts through 6 | Uses arrays to visually depict multiplication for facts through 12 |
| Recognizes basic fractions | Unable to identify $\frac{1}{2}$, $\frac{1}{3}$ and $\frac{1}{4}$ in a picture form with automaticity. | Can identify basic fractions in pictures and draw. | Can identify, say, and write basic fractions |
| Solves written and oral story problems using the correct operation | Able to solve problem if given plan and correct operation | Able to solve written and oral story problem with guidance in developing plan | Consistently able to solve written and oral story problem by developing a plan, using correct operation, and evaluating the solution |