

MASSACHUSETTS
CURRICULUM FRAMEWORK
FOR
MATHEMATICS

Grade Pre-Kindergarten

Incorporating the
Common Core State Standards for Mathematics

March 2011



The Standards for Mathematical Content

PRE-KINDERGARTEN

Introduction: The Pre-K Content Standards

Organization of the Pre-Kindergarten Content Standards

The pre-kindergarten through grade 8 content standards in this framework are organized by grade level. Within each grade level, standards are grouped first by domain. Each domain is further subdivided into clusters of related standards.

- Standards define what students should understand and be able to do.
- Clusters are groups of related standards. Note that standards from different clusters may sometimes be closely related, because mathematics is a connected subject.
- Domains are larger groups of related standards. Standards from different domains may sometimes be closely related.

The table below shows which domains are addressed at each grade level:

Progression of Pre-K–8 Domains										
Domain	Grade Level									
	PK	K	1	2	3	4	5	6	7	8
Counting and Cardinality	MA									
Operations and Algebraic Thinking	MA									
Number and Operations in Base Ten										
Number and Operations – Fractions										
The Number System							MA			
Ratios and Proportional Relationships										
Expressions and Equations										
Functions										
Measurement and Data	MA									
Geometry	MA									
Statistics and Probability										

Format for Each Grade Level

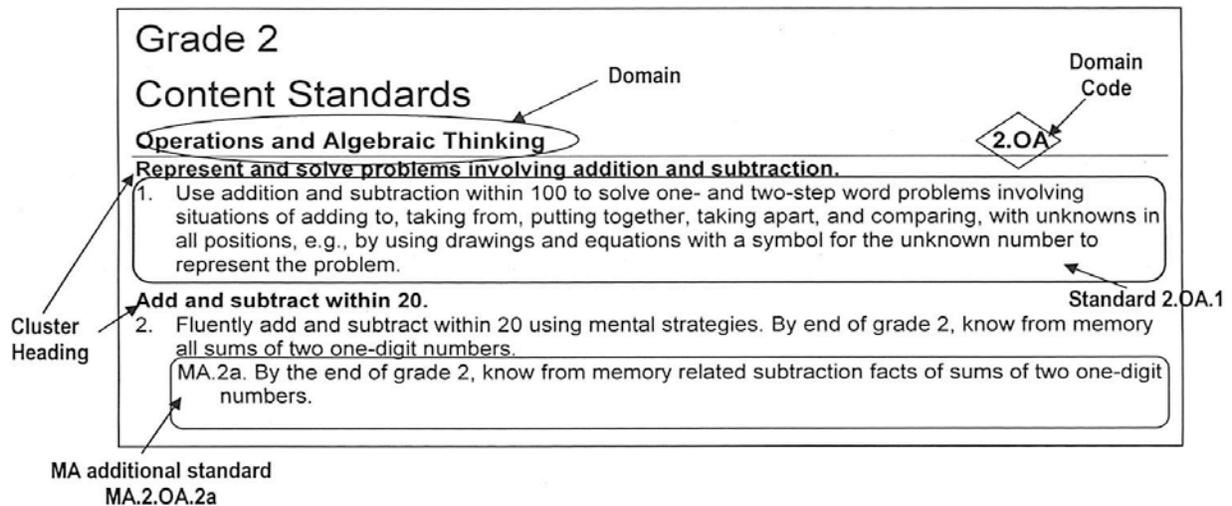
Each grade level is presented in the same format:

- an introduction and description of the critical areas for learning at that grade;
- an overview of that grade's domains and clusters; and
- the content standards for that grade (presented by domain, cluster heading, and individual standard).

Introduction: The Pre-K Content Standards

Standards Identifiers/Coding

Each standard has a unique identifier that consists of the grade level, (PK, K, 1, 2, 3, 4, 5, 6, 7, or 8), the domain code, and the standard number, as shown in the example on the next page.



The first standard highlighted above is identified as 2.OA.1, identifying it as a grade 2 standard in the Operations and Algebraic Thinking domain, and as the first standard in that domain.

Unique Massachusetts Standards

Standards unique to Massachusetts are included in the appropriate domain and cluster and are initially coded by "MA." The Massachusetts standard highlighted in the illustration above is identified as MA.2.OA.2a, with "MA" indicating a Massachusetts addition, "2" indicating a grade 2 standard, "OA" indicating the Operations and Algebraic Thinking domain, and "2a" indicating that it is a further specification to the second standard in that domain.

Introduction

The pre-kindergarten standards presented by Massachusetts are guideposts to facilitate young children's underlying mathematical understanding. The preschool/pre-kindergarten population includes children from the age of 2 years, 9 months until they are kindergarten-eligible. A majority attend programs in diverse settings—community-based early care and education centers, family child care, Head Start, and public preschools. Some children do not attend any formal program.

The Massachusetts pre-kindergarten standards apply to children who are at the end of this age group, meaning older four- and younger five-year olds. The standards—which correspond with the learning activities in the Massachusetts Guidelines for Preschool Learning Experiences (2003)—can be promoted through play and exploration activities, and embedded in almost all daily activities. They should not be limited to “math time.” In this age group, foundations of mathematical understanding are formed out of children's experiences with real objects and materials.

In preschool or pre-kindergarten, activity time should focus on two critical areas: (1) developing an understanding of whole numbers to 10, including concepts of one-to-one correspondence, counting, cardinality (the number of items in a set), and comparison; and (2) recognizing two-dimensional shapes, describing spatial relationships, and sorting and classifying objects by one or more attributes. Relatively more learning time should be devoted to developing children's sense of number as quantity than to other mathematics topics.

- (1) Young children begin counting and quantifying numbers up to 10. They begin with oral counting and recognition of numerals and word names for numbers. Experience with counting naturally leads to quantification. Children count objects and learn that the sizes, shapes, positions, or purposes of objects do not affect the total number of objects in the group. One-to-one correspondence matches each element of one set to an element of another set, providing a foundation for the comparison of groups and the development of comparative language such as more than, less than, and equal to.
- (2) Young children explore shapes and the relationships among them. They identify the attributes of different shapes, including length, area, and weight, by using vocabulary such as long, short, tall, heavy, light, big, small, wide, narrow. They compare objects using comparative language such as longer/shorter, same length, heavier/lighter. They explore and create 2- and 3-dimensional shapes by using various manipulative and play materials such as popsicle sticks, blocks, pipe cleaners, and pattern blocks. They sort, categorize, and classify objects and identify basic 2-dimensional shapes using the appropriate language.

The Standards for Mathematical Practice complement the content standards so that students increasingly engage with the subject matter as they grow in mathematical maturity and expertise throughout the elementary, middle, and high school years.

Pre-Kindergarten

Overview

Counting and Cardinality

- Know number names and the counting sequence.
- Count to tell the number of objects.
- Compare numbers.

- Understand addition as putting together and adding to, and understand subtraction as taking apart and taking from.

Measurement and Data

- Describe and compare measurable attributes.
- Classify objects and count the number of objects in each category.
- Work with money.

Geometry

- Identify and describe shapes (squares, circles, triangles, rectangles).
- Analyze, compare, create, and compose shapes.

STANDARDS FOR MATHEMATICAL PRACTICE

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for an express regularity in repeated reasoning.

Content Standards

Counting and Cardinality

PK.CC

Know number names and the counting sequence.

MA.1. Listen to and say the names of numbers in meaningful contexts.

MA.2. Recognize and name written numerals 0–10.

Count to tell the number of objects.

MA.3. Understand the relationships between numerals and quantities up to ten.

Compare numbers.

MA.4. Count many kinds of concrete objects and actions up to ten, using one-to-one correspondence, and accurately count as many as seven things in a scattered configuration.

MA.5. Use comparative language, such as more/less than, equal to, to compare and describe collections of objects.

Operations and Algebraic Thinking

PK.OA

Understand addition as putting together and adding to, and understand subtraction as taking apart and taking from.

MA.1. Use concrete objects to model real-world addition (putting together) and subtraction (taking away) problems up through five.

Measurement and Data

PK.MD

Describe and compare measurable attributes.

MA.1. Recognize the attributes of length, area, weight, and capacity of everyday objects using appropriate vocabulary (e.g., long, short, tall, heavy, light, big, small, wide, narrow).

MA.2. Compare the attributes of length and weight for two objects, including longer/shorter, same length; heavier/lighter, same weight; holds more/less, holds the same amount.

Classify objects and count the number of objects in each category.

MA.3. Sort, categorize, and classify objects by more than one attribute.

Work with money.

MA.4. Recognize that certain objects are coins and that dollars and coins represent money.

Geometry

PK.G

Identify and describe shapes (squares, circles, triangles, rectangles).

MA.1. Identify relative positions of objects in space, and use appropriate language (e.g., beside, inside, next to, close to, above, below, apart).

MA.2. Identify various two-dimensional shapes using appropriate language.

Analyze, compare, create, and compose shapes.

MA.3. Create and represent three-dimensional shapes (ball/sphere, square box/cube, tube/cylinder) using various manipulative materials (such as popsicle sticks, blocks, pipe cleaners, pattern blocks).

Applications of Common Core State Standards for: English Language Learners

¹²⁰The National Governors Association Center for Best Practices and the Council of Chief State School Officers strongly believe that all students should be held to the same high expectations outlined in the Common Core State Standards. This includes students who are English language learners (ELLs). However, these students may require additional time, appropriate instructional support, and aligned assessments as they acquire both English language proficiency and content area knowledge.

ELLs are a heterogeneous group with differences in ethnic background, first language, socioeconomic status, quality of prior schooling, and levels of English language proficiency. Effectively educating these students requires diagnosing each student instructionally, adjusting instruction accordingly, and closely monitoring student progress. For example, ELLs who are literate in a first language that shares cognates with English can apply first-language vocabulary knowledge when reading in English; likewise ELLs with high levels of schooling can often bring to bear conceptual knowledge developed in their first language when reading in English. However, ELLs with limited or interrupted schooling will need to acquire background knowledge prerequisite to educational tasks at hand. Additionally, the development of native-like proficiency in English takes many years and will not be achieved by all ELLs especially if they start schooling in the US in the later grades. Teachers should recognize that it is possible to achieve the standards for reading and literature, writing and research, language development, and speaking and listening without manifesting native-like control of conventions and vocabulary.

English Language Arts

The Common Core State Standards for English language arts (ELA) articulate rigorous grade-level expectations in the areas of speaking, listening, reading, and writing to prepare all students to be college and career ready, including English language learners. Second-language learners also will benefit from instruction about how to negotiate situations outside of those settings so they are able to participate on equal footing with native speakers in all aspects of social, economic, and civic endeavors.

ELLs bring with them many resources that enhance their education and can serve as resources for schools and society. Many ELLs have first language and literacy knowledge and skills that boost their acquisition of language and literacy in a second language; additionally, they bring an array of talents and cultural practices and perspectives that enrich our schools and society. Teachers must build on this enormous reservoir of talent and provide those students who need it with additional time and appropriate instructional support. This includes language proficiency standards that teachers can use in conjunction with the ELA standards to assist ELLs in becoming proficient and literate in English. To help ELLs meet high academic standards in language arts it is essential that they have access to:

- Teachers and personnel at the school and district levels who are well prepared and qualified to support ELLs while taking advantage of the many strengths and skills they bring to the classroom;
- Literacy-rich school environments where students are immersed in a variety of language experiences;
- Instruction that develops foundational skills in English and enables ELLs to participate fully in grade-level coursework;
- Coursework that prepares ELLs for postsecondary education or the workplace, yet is made comprehensible for students learning content in a second language (through specific pedagogical techniques and additional resources);
- Opportunities for classroom discourse and interaction that are well-designed to enable ELLs to develop communicative strengths in language arts;
- Ongoing assessment and feedback to guide learning; and
- Speakers of English who know the language well enough to provide ELLs with models and support.

Mathematics

ELL students are capable of participating in mathematical discussions as they learn English. Mathematics instruction for ELL students should draw on multiple resources and modes available in classrooms—such as objects, drawings, inscriptions, and gestures—as well as home languages and mathematical experiences outside of school. Mathematics instruction for ELLs should address mathematical discourse and academic language. This instruction involves much more than vocabulary lessons. Language is a resource for learning mathematics; it is not only a tool for communicating, but also a tool for thinking and reasoning mathematically. All languages and language varieties (e.g., different dialects, home or

¹²⁰ <http://www.corestandards.org/the-standards>

English Language Learners

everyday ways of talking, vernacular, slang) provide resources for mathematical thinking, reasoning, and communicating.

Regular and active participation in the classroom—not only reading and listening but also discussing, explaining, writing, representing, and presenting—is critical to the success of ELLs in mathematics. Research has shown that ELLs can produce explanations, presentations, etc., and participate in classroom discussions as they are learning English.

ELLs, like English-speaking students, require regular access to teaching practices that are most effective for improving student achievement. Mathematical tasks should be kept at high cognitive demand, teachers and students should attend explicitly to concepts; and students should wrestle with important mathematics.

Overall, research suggests that:

- Language switching can be swift, highly automatic, and facilitate rather than inhibit solving word problems in the second language, as long as the student’s language proficiency is sufficient for understanding the text of the word problem;
- Instruction should ensure that students understand the text of word problems before they attempt to solve them;
- Instruction should include a focus on “mathematical discourse” and “academic language” because these are important for ELLs. Although it is critical that students who are learning English have opportunities to communicate mathematically, this is not primarily a matter of learning vocabulary. Students learn to participate in mathematical reasoning, not by learning vocabulary, but by making conjectures, presenting explanations, and/or constructing arguments; and
- While vocabulary instruction is important, it is not sufficient for supporting mathematical communication. Furthermore, vocabulary drill and practice are not the most effective instructional practices for learning vocabulary. Research has demonstrated that vocabulary learning occurs most successfully through instructional environments that are language-rich, actively involve students in using language, require that students both understand spoken or written words and also express that understanding orally and in writing, and require students to use words in multiple ways over extended periods of time. To develop written and oral communication skills, students need to participate in negotiating meaning for mathematical situations and in mathematical practices that require output from students.

Application to Students with Disabilities

¹²¹The Common Core State Standards articulate rigorous grade-level expectations in the areas of mathematics and English language arts. These standards identify the knowledge and skills students need in order to be successful in college and careers.

Students with disabilities—students eligible under the Individuals with Disabilities Education Act (IDEA)—must be challenged to excel within the general curriculum and be prepared for success in their post-school lives, including college and/or careers. These common standards provide an historic opportunity to improve access to rigorous academic content standards for students with disabilities. The continued development of understanding about research-based instructional practices and a focus on their effective implementation will help improve access to mathematics and English language arts (ELA) standards for all students, including those with disabilities.

Students with disabilities are a heterogeneous group with one common characteristic: the presence of disabling conditions that significantly hinder their abilities to benefit from general education (IDEA 34 CFR §300.39, 2004). Therefore, how these high standards are taught and assessed is of the utmost importance in reaching this diverse group of students.

In order for students with disabilities to meet high academic standards and to fully demonstrate their conceptual and procedural knowledge and skills in mathematics, reading, writing, speaking and listening (English language arts), their instruction must incorporate supports and accommodations, including:

- Supports and related services designed to meet the unique needs of these students and to enable their access to the general education curriculum (IDEA 34 CFR §300.34, 2004).
- An Individualized Education Program (IEP)¹²² which includes annual goals aligned with and chosen to facilitate their attainment of grade-level academic standards.
- Teachers and specialized instructional support personnel who are prepared and qualified to deliver high-quality, evidence-based, individualized instruction and support services.

Promoting a culture of high expectations for all students is a fundamental goal of the Common Core State Standards. In order to participate with success in the general curriculum, students with disabilities, as appropriate, may be provided additional supports and services, such as:

- Instructional supports for learning based on the principles of Universal Design for Learning (UDL),¹²³ which foster student engagement by presenting information in multiple ways and allowing for diverse avenues of action and expression.
- Instructional accommodations (Thompson, Morse, Sharpe & Hall, 2005) – changes in materials or procedures which do not change the standards but allow students to learn within the framework of the Common Core.
- Assistive technology devices and services to ensure access to the general education curriculum and the Common Core State Standards.

Some students with the most significant cognitive disabilities will require substantial supports and accommodations to have meaningful access to certain standards in both instruction and assessment, based on their communication and academic needs. These supports and accommodations should ensure that students receive access to multiple means of learning and opportunities to demonstrate knowledge, but at the same time retain the rigor and high expectations of the Common Core State Standards.

¹²¹ <http://www.corestandards.org/the-standards>

¹²² According to IDEA, an IEP includes appropriate accommodations that are necessary to measure the individual achievement and functional performance of a child.

¹²³ UDL is defined as “a scientifically valid framework for guiding educational practice that (a) provides flexibility in the ways information is presented, in the ways students respond or demonstrate knowledge and skills, and in the ways students are engaged; and (b) reduces barriers in instruction, provides appropriate accommodations, supports, and changes, and maintains high achievement expectations for all students including students with disabilities and students who are limited English proficient” by Higher Education Opportunity Act (PL 110–135).