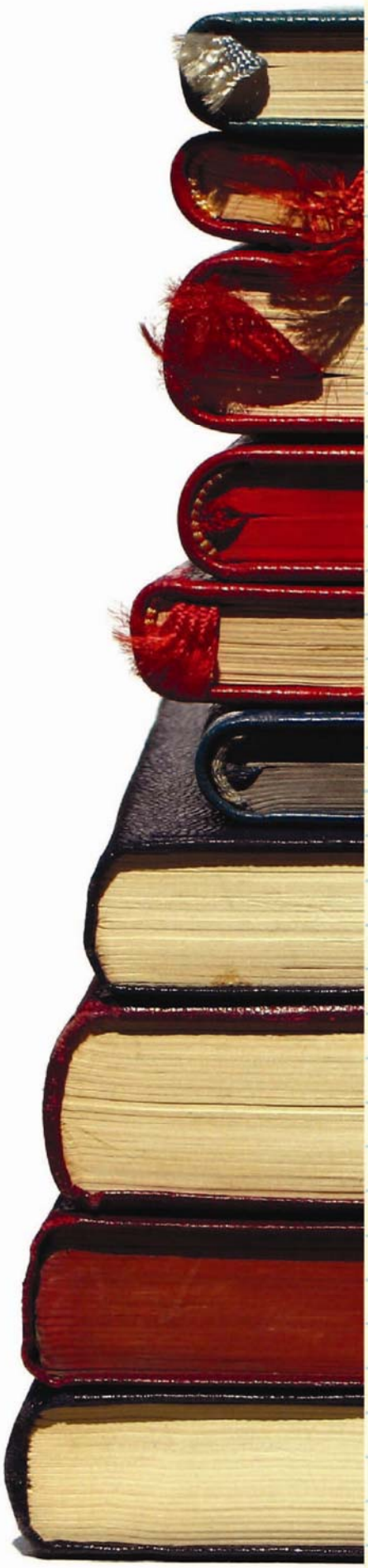

# Comprehensive Curriculum

Revised 2008

# Mathematics

Louisiana Department of
EDUCATION

Paul G. Pastorek, State Superintendent of Education

# State Board of Elementary and Secondary Education



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Web posting only

**Mathematics**
**Comprehensive Curriculum**
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# Preface

## Purpose of the Louisiana Comprehensive Curriculum

"*How well a school system works depends, in large part, on how well it aligns curriculum and assessment with standards throughout the district. In practical terms, this means that for students to succeed, they should be taught what they are expected to learn and assessed on what they are taught*."—Rebecca Burns, Curriculum Mapping

The Louisiana Department of Education is providing this revised version of the *Louisiana Comprehensive Curriculum* to every district in the state. The curriculum is aligned with state content standards, as defined by grade-level expectations (GLEs), and organized into coherent, time-bound units with sample activities and classroom assessments to guide teaching and learning.

### Focus on What Is Important to Teach

A written, aligned curriculum brings academic expectations into sharp focus by describing what instruction will be presented, to whom, when, and how. Without a written curriculum, textbooks often become the de facto curriculum of a school or district. Unfortunately, so much is included in textbooks that they have little ability to focus instruction or to provide the depth needed for good teaching and learning. While the Comprehensive Curriculum may be used in conjunction with textbooks, it will help teachers limit the topics they address to those the Louisiana standards define as important. This alignment with standards can focus classroom activities and ensure a depth of coverage that will help students achieve mastery (Schmidt et al., 2001; Alexander, 1960; FitzGerald, 1979; Palmer, 1967; White, 1988; Beck & McKeown, 1994; Kulm et al, 1999; Loewen, 1995; www.project2061.org; Crismore, 1985; Rowe, 1985; Harste, 1989).

### Align Content, Instruction, and Assessment to State Standards

Research indicates that alignment is a powerful indicator of academic achievement (Cohen, 1987; English & Steffy, 2001; Moss-Mitchell, 1998; Neidermeyer & Yelon, 1981; Porter et al., 1994; Porter & Smithson, 2001; Price-Braugh, 1997; Wishnick, 1989). Curriculum alignment is more than establishing a scope and sequence of instruction. Aligning the curriculum is the process of ensuring a good match between the state standards—specifically the GLEs—and the lessons taught in classrooms every day (Corallo & McDonald, 2002). This process ensures that instructional activities are aligned to standards, that an appropriate amount of time is devoted to the activities, that unnecessary repetitions in the instructional program are removed, that gaps in content are identified, and that classroom assessments are appropriate.

## Ensure Access for All Students

The Comprehensive Curriculum aligns with Louisiana standards, benchmarks, and the Grade-Level Expectations. Research indicates that an aligned curriculum can increase student achievement and helps to overcome the usual predictors of socioeconomic status, gender, race, and teacher quality variables (Laboratory Network Program, 1998; Moss-Mitchell, 1998; Wishnick, 1989). A pre-condition of a successful educational program is a clear and agreed understanding that instructional content and classroom assessments should reflect the instructional standards. In a district with a well-aligned curriculum, *all* students have the opportunity and responsibility to master the instructional content.

## Organize Content into Coherent, Time-Bound Units

Structure and content sequence of curriculum has an effect on its outcomes (Schmidt et al., 2001). Simply teaching the GLEs fragments knowledge and skills into bits and pieces, much like a collection of puzzle pieces that do not mean anything taken alone. Units of instruction create coherent curriculum contexts that organize and connect learning experiences. The Comprehensive Curriculum is organized into units that bring together groups of GLEs that make sense as a whole, thus helping students get the "big picture," like putting all the puzzle pieces together.

Each unit of this curriculum also includes time frames for mastering grade-level expectations included in the unit. The time frames help to govern time distribution among competing subject matter and topics (Zimmerman, 2001). When curriculum appropriately governs time *and* content, academic learning time—time students are on task while learning challenging content not learned previously—increases, and so will student achievement (Squires, Huitt, & Segars, 1983).

## Create Feedback Systems

The Comprehensive Curriculum units include assessment components that strengthen curriculum by providing feedback that students have learned what was taught. Many activities in the curriculum were designed to have products, and these products should be assessed using a rubric to determine whether the products indicate student mastery (Ceperley & Squires, 2000).

For the curriculum to have an effect, it must be implemented. To know whether a curriculum is implemented, someone must monitor. The district needs to decide who will monitor and when and how the appropriate information will be collected. Unit time frames may be the most convenient points to collect data on student progress, but other strategies also may be employed. These include peer observations, forums with stakeholders, surveys, and the like (Ceperley & Squires, 2000).

Continuous improvement of the curriculum is another important aspect of monitoring. If districts gather data on how students did on the unit assessments, they can then compare those results with how the students did on the state assessments. This information can inform further curriculum development, assessment revision, policies about course-taking sequences for students, and remedial or enrichment opportunities for students. Updating of curriculum should occur on a continuous basis (Ceperley & Squires, 2000; Schmoker, 1999).

**Serve as the Core of Professional Development**

Introducing a new curriculum often means introducing new content, teaching strategies, and administrative responsibilities. The district has the responsibility to ensure that all faculty and staff participate in appropriate professional development activities that will result in the successful implementation of the written curriculum (National Staff Development Council, 2001).

**Summary**

The Comprehensive Curriculum indicates one way to align instruction with Louisiana standards, benchmarks, and grade-level expectations with the goal of improving student achievement across the state. The curriculum has been developed to help districts build a bridge between classroom activities and state standards, so what happens in the classroom will indeed reflect Louisiana's vision for student learning.

## Principles of Mathematics Teaching and Learning

> *"Learning mathematics involves learning ways of thinking. It involves learning powerful mathematical ideas rather than a collection of disconnected procedures for carrying out calculations. But it also entails learning how to generate these ideas, how to express them using words and symbols, and how to justify to oneself and to others that those ideas are true."*—Carpenter, Franke, and Levi, Thinking Mathematically

Attempts to describe "mathematics" often fall back on talking about arithmetic, algebra, and geometry. However, mathematics as a field of study really addresses the development and understanding of structures, structures that give us a basis for thinking about quantities or relationships. Mathematics, like science, focuses on building models that enhance our ability to understand, manipulate, structure, and predict what will happen in a given context. These activities involve collecting, organizing, and interpreting data; developing fundamental ideas about the situations of interest; and creating and testing conjectures about the relationships connecting the central ideas of the topic of interest.

If ever we could, we can no longer afford for students to believe that doing mathematics involves mainly memorizing formulas and practicing algorithms that will potentially solve problems later in life. Students still need to learn basic facts, definitions, and the central concepts and procedures associated with the Louisiana mathematics strand areas—numbers and number relations; algebra; geometry; measurement; probability, statistics, and discrete mathematics; and patterns, relations, and functions. In addition, students need to see how mathematics provides a way of thinking about problems as diverse as studying social relationships and locating warehouses for a merchandising firm.

### Learning and Mathematics

Recent reviews of human development and learning have resulted in an understanding of the basic principles about how people learn (Bransford, Brown, & Cocking, 1999). These findings can be summarized as follows:

- Learning with understanding is facilitated when new and existing knowledge are structured around the major concepts and principles of a discipline.
- Learners use what they already know to construct new understandings.
- Learning is facilitated by use of metacognitive, or reflective, strategies that assist learners in identifying, monitoring, and regulating their cognitive processes.
- Learners have different strategies, approaches, patterns of developed abilities, and learning styles because of interactions between their opportunities to learn and their prior experiences.

- Learning is situated in activity and is shaped by the context and culture in which it occurs.
- Motivation to learn and sense of self affect what people learn, how much they learn, and how much effort they will put into the learning.
- Learning is enhanced through socially supported interactions (Gollub, Bertenthal, Labov, & Curtis, 2002, p. 119).

Students often learn and restructure information well when they work within a community of learners. According to Vygotsky (1978), in groups, individual learners share responsibility for managing information, generating hypotheses, and testing conjectures. In such contexts, learners often make substantial gains of knowledge and reasoning processes. Vygotsky argues that knowledge and understanding are products of social interactions involving talk, activity, and interaction about meaningful problems and appropriate tools.

Students need to see mathematical knowledge develop out of clear reasoning and thinking about situations. Students need opportunities to revisit previous learning as they build new understandings. Deep understanding flows from students' opportunities to modify and extend current knowledge through experiences with new situations and new information. Central to developing this level of understanding is metacognition—the student's ability to think outside his or her current work and reflect back on the thought processes and actions. This is true whether the actions are related to developing a new concept, applying a procedure, or solving a problem. Students who have learned to reflect on their thinking and actions are better situated to anchor new learning and apply it in productive ways (Lester, 1994; White & Frederickson, 1998).

**Representations.** Students need opportunities to see many different representations of the concepts they encounter in mathematics. For example, students should see how concepts play out in data or tables that relate values or in sketches or graphs that depict geometric situations. Students should have time to compare and contrast differing representations for concepts and principles, and instructional programs should pause to examine how and why equivalent representations are used to depict an idea in different ways. Such teaching for learning calls for examining a single problem in several ways, rather than several problems in one way. This approach to learning is responsive to students' differences by providing a multitude of linked representations and examining the nature of the links (Zemelman, Daniels, & Hyde, 1998).

**Mathematical self-worth.** Attending to the basics is not enough. Instructional programs must also challenge students to think about and justify their work, much as mathematicians do when they confront new problems (Ball & Bass, 2000, Ball & Bass, in press). Students' conceptions of themselves as learners are important in this process, especially when the situations they face require creativity and perseverance. Learning is facilitated when it can be connected to major aspects of a student's cultural experiences. This is especially true for students who are members of underrepresented groups within a discipline (Cocking & Mestre, 1988; Malloy & Brader-Araje, 1998; Ortiz-Franco, Hernandez, & DeLea Cruz, 1998; Secada, Fennema, & Adajian, 1994).

## Organization of the Comprehensive Curriculum

### Components of the Comprehensive Curriculum

The components of the Comprehensive Curriculum are intended to be reflective of the components that should be included in any good curriculum. The components are described below.

| Curriculum Component | Explanation |
|---|---|
| **Cover page** | Displays content area and courses included in the document, name of the agency that developed the document, and the date the document was developed |
| **Title page** | Displays content area and courses included in the document, name of the agency that developed the document, and the date the document was developed |
| **Board of Education** | Lists the names of board members who approved the use of the curriculum document and the name of the superintendent |
| **Acknowledgments (optional)** | Lists individuals or groups who contributed to the development of the local curriculum |
| **Table of Contents** | Lists the courses and other curriculum components and where they can be found in the document |
| **Preface** | Provides background information including underlying law and policies that led to the development of the document |
| **Purpose** | Provides a statement of the intended purpose of the written, aligned curriculum, expectations for its use in the classroom, and the expected results in terms of student performance. |
| **Principles of teaching and learning for specific content area** | States beliefs about the content area and research-based principles of successful teaching and learning |
| **Professional Development** | Provides a summary statement of how appropriate professional development ensures that teachers possess knowledge and skills needed to teach the new curriculum |
| **PreK–12 Courses** | Includes a copy of each course in the relevant content area |

## Elements of the Comprehensive Curriculum Units

The unit organizer format allows teachers to see the interrelationships among the GLEs and indicates best practice activities that should be used when teaching a particular concept or skill.

| Unit Element | Explanation |
|---|---|
| **Time Frame** | An approximate time frame is specified for each unit of instruction (e.g., approximately two to three weeks). The time frame helps teachers pace instruction and learning. The time frame also helps administrators monitor the implementation of the curriculum. |
| **Course Name** | The course name specifies the grade level and the content area for courses Prekindergarten through Grade 8 (e.g., Grade 3 English Language Arts). For high school courses (Grades 9–12), the name specifies the content (e.g., Algebra I). |
| **Unit Title** | Each unit has a title designed to bring further focus to the collection of ideas and concepts to be learned in that unit (e.g., Poetry, Measuring and Comparing, and so on). |
| **Unit Number** | Units are numbered sequentially (e.g., Unit 1, Unit 2, and so on). |
| **Unit Description** | The unit description states broadly, in one or two sentences, the intent of the unit (e.g., The focus of this unit is how the availability of resources influences economic decisions). |
| **Student Understandings** | Student understandings are a brief description of the overarching concepts to be learned by the student. |
| **Guiding Questions** | This element contains a list of questions that teachers can use to determine if students understand the concepts being taught (e.g., Can students use the structure of the article to find information they need?) |
| **Grade-Level Expectations (GLEs)** | For each unit, there is a table that lists the number and the text of each GLE to be addressed by the unit. Benchmark codes are included at the end of each GLE. |
| **Sample Activities** | Each activity is numbered, named, and lists the GLE(s) that are addressed by the activity. It provides guidance to teachers as they plan their lessons throughout the school year. |
| **Sample Assessments** | At the end of each unit are suggested assessments that are linked to the processes of teaching and learning (e.g., graded homework, class projects, performance tasks, discussions with teachers, parents, classmates, diagnostic tests, teacher-made tests and quizzes, observation systems, performance assessment based on performance levels as defined by rubrics, portfolios, and so on). |
| **Blackline Masters** | Blackline masters are provided in a separate document for each course and are designed to assist in the implementation of an activity. Most blackline masters are for student use; however, some provide rubrics for evaluating student work or provide solution keys for student worksheets. |

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