MICHIGAN
CURRICULUM
FRAMEWORK

Michigan Department of Education

MICHIGAN
STATE BOARD OF EDUCATION

Michigan Curriculum Framework

Michigan Department of Education
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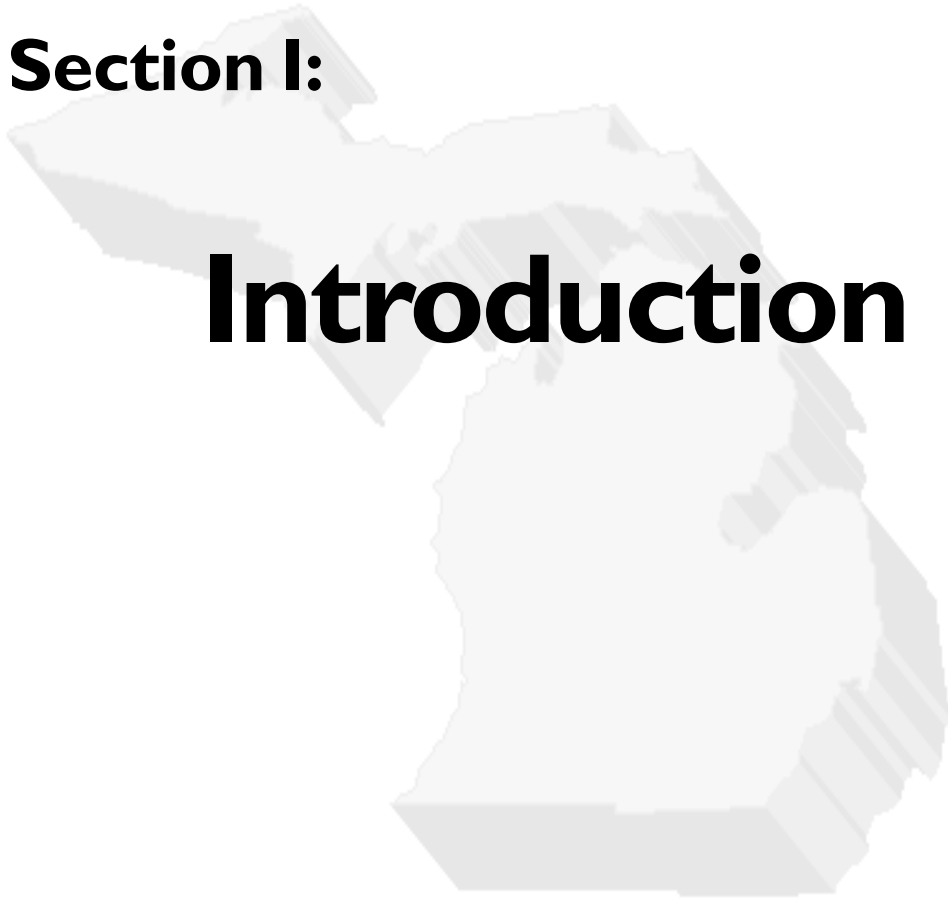
INTRODUCTION

The *Michigan Curriculum Framework* is a resource for helping Michigan's public and private schools design, implement, and assess their core content area curricula. The content standards identified in this document are presented as models for the development of local district curriculum by the Michigan State Board of Education and the Michigan Department of Education. They represent rigorous expectations for student performance, and describe the knowledge and abilities needed to be successful in today's society. When content, instruction, and local and state assessments are aligned, they become powerful forces that contribute to the success of student achievement.

The framework presents a content and a process for developing curriculum that enables schools to realize Michigan's vision for K-12 education:

Michigan's K-12 education will ensure that all students will develop their potential in order to lead productive and satisfying lives. All students will engage in challenging and purposeful learning that blends their experiences with content knowledge and real-world applications in preparation for their adult roles, which include becoming:

- ◆ *literate individuals*

- ◆ *healthy and fit people*

- ◆ *responsible family members*

- ◆ *productive workers*

- ◆ *involved citizens*

- ◆ *self-directed, lifelong learners*

The intent of this document is to provide useful resources to districts as they strive to implement a program which ensures that all students reap the benefits of a quality education and achieve the adult roles described in Michigan's vision for K-12 education. The content standards and benchmarks serve as worthy goals for all students as they develop the knowledge and abilities inherent in their adult roles. They represent an essential component in the process of continuous school improvement, which like professional development, should be focused on improving student achievement.

We believe that efforts to set clear, common, state and/or community-based academic standards for students in a given school district or state are necessary to improve student performance. Academic standards clearly define what students should know and be able to do at certain points in their schooling to be considered proficient in specific academic areas. We believe that states and communities can benefit from working together to tap into the nation's best thinking on standards and assessments.

1996 National Education Summit Policy Statement

The framework emphasizes the importance of:

- ◆ using continuous school improvement to align all district initiatives for the purpose of increasing student achievement;

- ◆ building a curriculum based on rigorous content standards and benchmarks;

- ◆ using student achievement data to make decisions about continuous school improvement, curriculum, instruction, and professional development; and,

- ◆ incorporating research-supported teaching and learning standards into daily instructional practice.

BACKGROUND

In 1993, the Michigan Department of Education, in collaboration with representatives from five state universities, was awarded federal funding from the U.S. Department of Education to develop curriculum framework components for English language arts, mathematics, science, and geography. In addition, the Michigan Council for the Social Studies offered, and was supported by the State Board of Education, to develop a curriculum framework component for social studies which would include history, economics, and American government, and would be complementary to the geography framework.

The *Michigan Curriculum Framework* brings together the work of individual content area projects to present a unified view of curriculum, one which addresses the educational needs of the whole learner. The goal of the curriculum framework is to improve student achievement by aligning classroom instruction with core curriculum content standards and national content standards. It is designed to be used as a process for the decision-making that guides continuous school improvement. It describes curriculum, instruction, and assessment and focuses on improving program quality by aligning all the processes that affect a student's achievement of rigorous content standards.

Framework project co-directors, university representatives, and the Michigan Department of Education content area consultants met regularly with members of their content area professional organizations to design the components of the curriculum framework. Committees of teachers and university personnel worked together to draft the content standards, benchmarks, and performance standards for their specific content areas.

Co-directors met on a monthly basis to coordinate the efforts of the various content area committees in developing K-12 standards and benchmarks for their subject areas. Their purpose was to ensure that the framework represents a consistent view of curriculum across content areas. They wanted to facilitate continuous school improvement by emphasizing commonalities among the content areas with regard to professional development, assessment, and instruction.

"S*etting high standards for our children. It's the sine qua non for any other reforms anyone might want to implement. We can't judge the efficacy of ideas because we have no yardsticks by which to measure success or failure."*

Louis V. Gerstner
Chairman and CEO, IBM

The co-directors were guided by a Joint Steering Committee comprised of representatives from the content areas, parents, business leaders, labor leaders, house and senate staff, and educators. Joint Steering Committee members reviewed the framework projects at each phase of their development and made recommendations for improving their quality. Their insight helped the co-directors incorporate the views of all of Michigan's interested parties into the final framework document.

WHAT IS IN THE FRAMEWORK?

The framework includes the resources needed to develop a standards-based curriculum. Standards and benchmarks for English language arts, mathematics, science, and social studies are included in this edition of the framework. Standards and benchmarks for arts education, career and employability skills, health education, life management education, physical education, technology education, and world languages will be added to the next edition of the framework. The process described in the framework will be expanded to incorporate the additional core content areas when they are completed. The chart on page vi provides a list of the materials that eventually will be included in the framework document.

Tier I

Content Standards and Benchmarks

Tier I begins with a complete list of core curriculum content standards and benchmarks for grades K-12 in the areas of English language arts, mathematics, science and social science. The standards describe what all students should know and be able to do in each of the subject areas. The benchmarks indicate what students should know and be able to do at various developmental levels (i.e., early elementary school, later elementary school, middle school, and high school).

Planning

The framework includes a planning section. It provides a model for using the standards and benchmarks to create a local district curriculum as part of continuous school improvement. It discusses the importance of involving representatives from all stakeholders in the curriculum development process. In addition, it emphasizes the need for alignment among all of the processes that comprise continuous school improvement and focuses attention on placing student achievement at the center of all decision-making. It emphasizes the need for continuity in a K-12 curriculum. Continuity is developed by clearly defining benchmarks that establish increasingly complex demonstrations of rigorous standards.

Teaching and Learning

The section on teaching and learning describes standards that are the foundation to successful learning in all content areas. The standards include deep knowledge, higher-order thinking, substantive conversation, and connections to the world beyond the classroom. It illustrates the standards through sample

teaching vignettes in each of the content areas. It discusses the importance of incorporating strategies for technology, connecting with the learner, interdisciplinary learning, and making school-to-work connections into the curriculum.

Assessment System

The framework contains a section on assessment which describes the need for developing a local assessment system to monitor student growth and program effectiveness. This section of the framework is divided into three parts. The first part provides a rationale for why an assessment system is needed. The second part describes how teachers can develop performance assessments based on the content standards and benchmarks. The third part discusses important issues related to building an assessment system that aligns local assessment practices with state assessment.

Professional Development

The section on professional development lists standards for the context, content, and process of professional development experiences. It includes a process for designing professional development which aligns with school improvement, curriculum content, student learning, and assessment needs. A vignette of one teacher's personal, professional development experiences is provided to illustrate Michigan's Standards for Professional Development.

Executive Summaries and Glossary

The appendices of the framework contain executive summaries of important resources that will aid a district as it develops, implements, and monitors its local curriculum. A glossary of framework terms is also provided.

Tier II

Toolkits

Tier II contains a collection of toolkits designed to help districts with specific tasks such as conducting discrepancy analyses. There are additional toolkits to guide districts in incorporating principles associated with connecting with the learner, technology, curriculum integration, and making school-to-work connections. There are toolkits on planning subject area instructional units, designing classroom assessments, and planning a district assessment system. *(Some of the above mentioned toolkits are still under development.)*

Tier III

Resources

Tier III contains content-area specific resources that help clarify the curriculum development process described in the framework. These include resources such as the *Science Education Guidebook*, the *Mathematics Teaching and Learning Sample Activities*, *Guidelines for the Professional Development of Teachers of English Language Arts*, and *Powerful & Authentic Social Studies Standards for Teaching.* It also

contains a guidebook written specifically for parents and the business community explaining the elements of the framework.

HOW TO USE THE FRAMEWORK

District school improvement committees and curriculum development committees will find the framework and its toolkits very useful as they begin the process of creating a standards-based curriculum. Reading and discussing the contents of the framework will help school improvement committee members gain a clearer understanding of the curriculum development process. The toolkits will help subcommittees develop techniques for creating and aligning curriculum, assessment, and instruction. They will also help districts make decisions about the professional development strategies which will most effectively help their students reach targeted achievement goals.

The first step in using the framework is to make sure that all interested parties are familiar with its content. Then an analysis to determine what needs to be done should be completed. Once the district identifies the tasks that need to be completed, a plan for structuring committees and a time-line for completing the tasks should be designed.

The framework is intended for use by all districts. While the writers used the structure of a middle-sized district as a frame of reference, the content and processes it describes are equally important for large and small districts. Although private schools are not bound by the core curriculum requirements of the Michigan School Code, they may find the framework useful as a tool for curriculum development. Large districts, small districts, private schools, and public school academies may choose to modify the process to reflect their organizational structures. The number and size of committees needed to implement the framework will vary from district to district, but the task will remain the same: to align curriculum, instruction, assessment, and professional development for the purpose of increasing student achievement of rigorous content standards.

Michigan Curriculum Framework

TIER I

TIER II

TIER III

This document introduces the framework standards and describes the components and processes needed to develop K-12 curricula.

These documents are toolkits designed to help districts achieve alignment while developing curriculum, instruction, and assessment consistent with their standards and benchmarks. (For availability, see http://www.mde.state.mi.us)

These resources are specific to each content area and help clarify and strengthen the curriculum development processes described in the first two tiers. (For availability, see http:/www.mde.state.mi.us)

Introduction

Standards & Benchmarks

Planning

Discrepancy Analysis
1. Analysis of Curriculum
2. Analysis of Instruction
3. Analysis of Assessment
4. Analysis of Professional Development
5. Analysis of School Operations

- **Michigan Geography Framework Poster**
- **Analysis of Mathematics Instructional and Assessment Materials**
- **Mathematics Research Component**
- **Social Studies Curriculum Planning Guide**

Teaching and Learning

Connecting with the Learner
Technology
Curriculum Integration
Connecting School-To-Work

- **Science Education Guidebook**
- *New Directions* **Science Teaching Units**
- **Profiles of Early Literacy Instruction in Primary Classrooms**
- **A Collection of English Language Arts Vignettes**
- **Readings from the Demonstration Projects**
- **Mathematics Teaching and Learning Sample Activities**
- **Standards Based Geography Units**
- **Powerful & Authentic Social Studies: Standards for Teaching and Learning**

Assessment System

Local Assessment System

- **Mathematics Assessment Framework**
- **The Model Assessment Items Resource Book** *(Science)*
- **Michigan Assessment Prototypes for Geography**
- **Plan for Statewide Assessment of Social Studies**
- **Social Studies Assessment Guide**

Professional Development

Executive Summaries of Toolkits and Other Resources

- **Guidelines for the Professional Development of Teachers of English Language Arts**
- **Mathematics Professional Development Component**
- **Powerful and Authentic Social Studies Professional Development Package**
- **Powerful and Authentic Social Studies Standards for Teaching**

Parent and Business Leader Guides (under development)

Section II:

Content Standards
& Draft Benchmarks
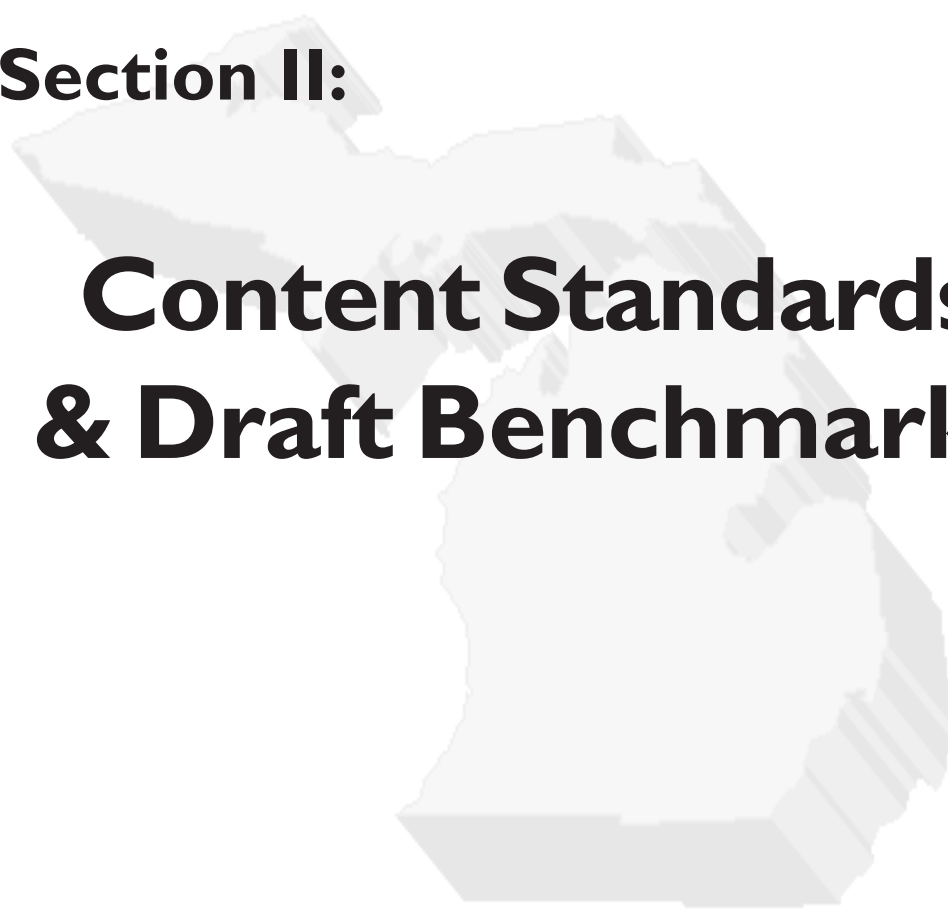
CONTENT STANDARDS & DRAFT BENCHMARKS

At its July 19, 1995, meeting, the Michigan State Board of Education unanimously adopted the model content standards for curriculum. The content standards provide descriptions of what students should know and be able to do in the subject areas of English language arts, social studies, mathematics and science. In addition, benchmarks in each of the content areas were drafted to further clarify the content standards. The standards and benchmarks are not a state curriculum, but are specifically designed to be used by local districts as they develop their curricula.

The model content standards for curriculum and accompanying draft benchmarks will assist in the development of quality comprehensive local curricula, foster local diversity in establishing high quality learning expectations, and give parents, as customers within an education marketplace, an accountability tool. In addition, they will serve as a basis for revisions and new test development for the MEAP and High School Proficiency Tests. They will provide a common denominator to determine how well students are performing and will assure that all students are measured on the same knowledge and skills using the same method of assessment.

Model Content Standards for Curriculum

The model content standards for curriculum were revised, based upon public input, by writing teams in each of the content areas. The Curriculum Framework Joint Steering Committee which includes representatives from business, education, government, professional organizations, and labor was extensively consulted in the development and revision of the standards. The State Board also made revisions to the standards during its July 19, 1995, meeting.

Benchmarks

The draft benchmarks provide indicators of student expectations at various developmental levels including elementary, middle school, and high school. The working draft benchmarks are the most current versions and represent the efforts made by teams of subject area specialists with input from over 2,000 Michigan citizens.

Field reviews on the benchmarks were held to gather comments from teachers, parents, administrators, and community members. Additionally, the benchmarks have been reviewed for consistency with the model content standards for curriculum. The department continues the process of field testing the benchmarks at the Curriculum Framework projects' school demonstration sites.

SOC.II.1.LE.1

SOC. Social Studies
(Subject Area)

II. Geographic Perspective
(Content Strand)

1. All students will
describe, compare, and
explain the locations and
characteristics of places,
cultures, and settlements.
(People, Places and
Cultures) *(Content
Standard)*

LE. Later Elementary

1. Locate and describe
cultures and compare the
similarities and differences
among the roles of women,
men and families. *(Later
Elementary Benchmark)*

Because the benchmarks are continuously being revised to
further clarify the standards and reflect the learning needs of
Michigan's students, districts should consult electronic versions
in order to ensure that they are working with the most current
revisions. The model content standards for curriculum and the
working draft benchmarks are available through the Internet on
the Department of Education's gopher server (gopher://
gopher.mde.state.mi.us), and through the World Wide Web
(http://cdp.mde.state.mi.us).

Please note: The standards and benchmarks have been coded
so that districts can more easily refer to them in their
curriculum, instruction, assessment, and professional
development activities. The numbering system will be useful
as districts conduct discrepancy analyses as part of the
continuous school improvement decision-making process. One
system for numbering has been applied to all of the content
standards and benchmarks in an attempt to provide
consistency and facilitate curriculum alignment.

The numbering system begins with the subject area. English
language arts is assigned the code of ELA; Mathematics, MAT;
Social Studies, SOC; and Science, SCI. The first numeral in the
code is a Roman numeral; it identifies the content area strand.
The second numeral is an Arabic numeral; it identifies a
content standard. The letters that follow the content standard
signify cluster levels such as: E (elementary), EE (early
elementary), LE (later elementary), MS (middle school), and HS
(high school). The third numeral is another Arabic
numeral; it identifies a benchmark.

The coding system has been used to identify standards and
benchmarks in the sections on assessment and teaching and
learning. Please note that although one coding system is used,
each set of content areas and benchmarks has some unique
characteristics. For instance, the English language arts
standards and benchmarks do not identify strands. It is very
important to study the standards and benchmarks carefully so
they can be used to their full advantage.

English Language Arts

The English language arts are the vehicles of communication by which we live, work, share, and build ideas and understandings of the present, reflect on the past, and imagine the future. Through the English language arts, we learn to appreciate, integrate, and apply what is learned for real purposes in our homes, schools, communities, and workplaces.

The English language arts encompass process and content— *how* people communicate as well as **what** they communicate. **Process** includes skills and strategies used in listening, speaking, reading, writing, and viewing. **Content** includes the ideas, themes, issues, problems, and conflicts found in classical and contemporary literature and other texts, such as technical manuals, periodicals, speeches, and videos. Ideas, experiences, and cultural perspectives we discover in texts help us shape our vision of the world. The insights we gain enable us to understand our cultural, linguistic, and literary heritages.

The ultimate goal for all English language arts learners is personal, social, occupational, and civic literacy.

A literate individual:

- communicates skillfully and effectively through printed, visual, auditory, and technological media in the home, school, community, and workplace;

- thinks analytically and creatively about important themes, concepts, and ideas;

- uses the English language arts to identify and solve problems;

- uses the English language arts to understand and appreciate the commonalities and differences within social, cultural, and linguistic communities;

- understands and appreciates the aesthetic elements of oral, visual, and written texts;

- uses the English language arts to develop insights about human experiences;

- uses the English language arts to develop the characteristics of lifelong learners and workers, such as curiosity, persistence, flexibility, and reflection; and,

- connects knowledge from all curriculum areas to enhance understanding of the world.

Vision Statement

OVERVIEW OF ENGLISH LANGUAGE ARTS CONTENT STANDARDS

English language arts education in Michigan incorporates the teaching and learning of reading, writing, speaking, listening, and viewing. Integration of the English language arts occurs in multiple ways. First, English language arts curriculum, instruction, and assessment reflect the integration of listening, speaking, viewing, reading, and writing. The English language arts are not perceived as individual content areas, but as one unified subject in which each of the five areas supports the others and enhances thinking and learning. Secondly, there is integration of the teaching and learning of content and process within the English language arts. The common human experiences and the ideas, conflicts, and themes embodied in literature and all oral, written, and visual texts provide a context for the teaching of the processes, skills, and strategies of listening, speaking, viewing, reading, and writing. Finally, literacy educators believe that the knowledge, skills, and strategies of the English language arts are integrated throughout the curriculum, enabling students to solve problems and think critically and creatively in all subject areas.

In grades K-12, a locally developed English language arts curriculum, embodying these state content standards, will ensure that all students are literate and can engage successfully in reading, discovering, creating, and analyzing spoken, written, electronic, and visual texts which reflect multiple perspectives and diverse communities and make connections within English language arts and between English language arts and other fields.

Standard 1, 2, 3 Meaning and Communication
All students will read and comprehend general and technical material.

All students will demonstrate the ability to write clear and grammatically correct sentences, paragraphs, and compositions.

All students will focus on meaning and communication as they listen, speak, view, read, and write in personal, social, occupational, and civic contexts.

The essence of the English language arts is communication— exchanging and exploring information and insights. We are meaning-makers who strive to make sense of our world. We use the English language arts in every area of our lives, not just the classroom. They help us deal with other people in the world around us. Listening, speaking, viewing, reading, and writing are naturally integrated in our attempts to communicate. We continually improve our understanding by using our past experiences, the circumstances in which we find ourselves, and what we are hearing, reading, or viewing. Only when we understand or when we are understood are we communicating—only then are we using the English language arts.

Standard 4. Language
All students will use the English language effectively.

When we use the English language, we use it in many different ways and forms. The forms of language that we use depend upon the audience and the type of message we want to communicate. Our language is different when we use it in a formal setting, such as speaking to an assembly or writing to apply for a job, as opposed to talking with friends about a recent event or writing a personal diary. As we grow in our ability to use language, we learn what forms and types of language are best suited for different situations. Instruction, as well as experiencing language in many different settings, helps us learn to understand and use the forms and types of language which are best suited for our purposes.

Standard 5. Literature
All students will read and analyze a wide variety of classic and contemporary literature and other texts to seek information, ideas, enjoyment, and understanding of their individuality, our common heritage and common humanity, and the rich diversity of our society.

One of the important ways we learn to use language effectively is through our close reading of a wide range of well-constructed texts used for a variety of purposes. The reading of both fiction and non-fiction high-quality literature allows us to experience and learn things that we might not experience in our daily lives; reading helps us to understand the actions, thoughts, and feelings of others who may or may not be like us. Exploring texts that our ancestors felt important, as well as texts that represent other cultures and other times, helps to increase our understanding of ourselves, our communities, and our world.

Standard 6. Voice
All students will learn to communicate information accurately and effectively and demonstrate their expressive abilities by creating oral, written, and visual texts that enlighten and engage an audience.

Our ability to create oral, written, and visual texts that engage audiences is enhanced when we view ourselves as effective users of the English language arts. We develop our own voices by listening, reading, viewing, speaking, and writing about issues that are of great importance to us. Exploring how authors work provides us with opportunities to examine a variety of writing models from which we can learn the tools of language such as style, word choice, persuasiveness, and sentence structure.

Standard 7. Skills and Processes
All students will demonstrate, analyze, and reflect upon the skills and processes used to communicate through listening, speaking, viewing, reading, and writing.

Effective communication depends upon our ability to recognize, when attempts to construct and convey meaning, work well and when they have broken down. We must monitor, reflect, and adjust our communication processes for clarity,

correctness, purpose, and audience. We need to learn multiple strategies for constructing and conveying meaning in written, spoken, and visual texts. Our literacy development depends upon on-going, personal, self-regulated assessment.

Standard 8. Genre and Craft of Language
All students will explore and use the characteristics of different types of texts, aesthetic elements, and mechanics—including text structure, figurative and descriptive language, spelling, punctuation, and grammar—to construct and convey meaning.

Reading a variety of texts helps us develop an understanding and appreciation of the writer's craft. We learn that there are many different and effective ways to convey meaning. Exploring how artists, writers, and speakers communicate successfully helps us employ effective techniques in our own efforts to communicate meaning based on our purpose, content, and audience. We increase our ability to use the mechanics of writing to achieve correctness and clarity when we reflect upon and create a variety of genre.

Standard 9. Depth of Understanding
All students will demonstrate understanding of the complexity of enduring issues and recurring problems by making connections and generating themes within and across texts.

We can explore complex human issues by learning to identify key concepts and themes in literature, by examining and reflecting upon diverse viewpoints, by summarizing arguments, and by presenting our own positions. We learn to use themes and topics from texts to make connections, see patterns, and demonstrate a deep and rich understanding of the enduring issues and recurring problems that characterize human experience.

Standard 10. Ideas in Action
All students will apply knowledge, ideas, and issues drawn from texts to their lives and the lives of others.

Themes and issues explored in texts provide us with many ideas about the world, our communities, and our own place within them. Continued research and analysis of these themes enable us to enhance the skills needed to respond to the issues in our lives that concern and inspire us. It is critical that we use these skills to choose appropriate responses in areas that are important to us now in order to prepare for the future.

Standard 11. Inquiry and Research
All students will define and investigate important issues and problems using a variety of resources, including technology, to explore and create texts.

An important use of the English language arts is to understand concepts and to create new knowledge. As we continue to improve our ability to collect, analyze, and evaluate information, we will increase our ability to contribute to the businesses that employ us and the communities in which we choose to live. In order to best accomplish this, we need to be able to find information in a variety of forms and to organize it

in a way that allows better understanding and new insights. Many tried-and-true methods work well, such as library searches, interviews, card files, and outlines. Today, we have new technologies that can facilitate this process, such as electronic library catalogs, e-mail, and fax machines. Use of technology gives us more time to concentrate on the most important component of research, the thinking skills of inquiry, which we use when we formulate questions and hypotheses, analyze and synthesize information, and draw reasonable conclusions.

Standard 12. Critical Standards
All students will develop and apply personal, shared, and academic criteria for the employment, appreciation, and evaluation of their own and others' oral, written, and visual texts.

Experiences in the English language arts help us to recognize and develop standards of quality for evaluating and appreciating literature and other oral, written, and visual texts. We develop indicators of quality by analyzing those that are recognized as time-honored standards. As we assimilate and modify these indicators, we generate our own personal standards which continue to evolve as we grow in our experience and gain knowledge in the English language arts.

ENGLISH LANGUAGE ARTS

CONTENT STANDARDS AND WORKING DRAFT BENCHMARKS

MEANING AND COMMUNICATION

Content Standard 1: All students will read and comprehend general and technical material.

Early Elementary	Later Elementary	Middle School	High School
1. Use reading for multiple purposes, such as enjoyment, gathering information, and learning new procedures.	1. Use reading for multiple purposes, such as enjoyment, gathering information, learning new procedures, and increasing conceptual understanding.	1. Use reading for multiple purposes, such as enjoyment, clarifying information, and learning complex procedures.	1. Use reading for multiple purposes, such as enjoyment, learning complex procedures, completing technical tasks, making workplace decisions, evaluating and analyzing information, and pursuing in-depth studies.
2. Read with developing fluency a variety of texts, such as stories, poems, messages, menus, and directions.	2. Read with developing fluency a variety of texts, such as short stories, novels, poetry, textbooks, menus, periodicals, and reference materials.	2. Read with developing fluency a variety of texts, such as short stories, novels, poetry, plays, textbooks, manuals, and periodicals.	2. Read with developing fluency a variety of texts, such as novels, poetry, drama, essays, research texts, technical manuals, and documents.
3. Employ multiple strategies to construct meaning, including word recognition skills, context clues, retelling, predicting, and generating questions.	3. Employ multiple strategies to construct meaning, including the use of sentence structure, vocabulary skills, context clues, text structure, mapping, predicting, retelling, and generating questions.	3. Employ multiple strategies to construct meaning, such as generating questions, studying vocabulary, analyzing mood and tone, recognizing how authors use information, generalizing ideas, matching form to content, and developing reference skills.	3. Selectively employ the most effective strategies to construct meaning, such as generating questions, scanning, analyzing, and evaluating for specific information related to a research question, and deciding how to represent content through summarizing, clustering, and mapping.
4. Employ multiple strategies to decode words as they construct meaning, including the use of phonemic awareness, letter-sound associations, picture cues, context clues, and other word recognition aids.	4. Employ multiple strategies to recognize words as they construct meaning, including the use of phonics, syllabication, spelling patterns, and context clues.	4. Employ multiple strategies to recognize words as they construct meaning, including the use of context clues, word roots and affixes, and syntax.	4. Selectively employ the most effective strategies to recognize words as they construct meaning, including the use of context clues, etymological study, and reference materials.

5. Respond to the ideas and feelings generated by oral, visual, written, and electronic texts, and share with peers.	5. Respond to oral, visual, written, and electronic texts, and compare their responses to those of their peers.	5. Respond to a variety of oral, visual, written, and electronic texts by making connections to their personal lives and the lives of others.	5. Respond personally, analytically, and critically to a variety of oral, visual, written, and electronic texts, providing examples of how texts influence their lives and their role in society.

Content Standard 2: All students will demonstrate the ability to write clear and grammatically correct sentences, paragraphs, and compositions.

Early Elementary	**Later Elementary**	**Middle School**	**High School**
1. Write with developing fluency for multiple purposes to produce a variety of texts, such as stories, journals, learning logs, directions, and letters.	1. Write fluently for multiple purposes to produce compositions, such as stories, reports, letters, plays, and explanations of processes.	1. Write fluently for multiple purposes to produce compositions, such as personal narratives, persuasive essays, lab reports, and poetry.	1. Write fluently for multiple purposes to produce compositions, such as stories, poetry, personal narratives, editorials, research reports, persuasive essays, resumes, and memos.
2. Recognize that authors make choices as they write to convey meaning and influence an audience. Examples include word selection, sentence variety, and genre.	2. Recognize and use authors' techniques in composing their own texts. Examples include effective introductions and conclusions, different points of view, grammatical structure, and appropriate organization.	2. Recognize and use authors' techniques that convey meaning and build empathy with readers when composing their own texts. Examples include appeals to reason and emotion, use of figurative language, and grammatical conventions which assist audience comprehension.	2. Recognize and approximate authors' innovative techniques to convey meaning and influence an audience when composing their own texts. Examples include experimentation with time, stream of consciousness, multiple perspectives, and use of complex grammatical conventions.
3. Begin to plan and draft texts, and revise and edit in response to the feelings and ideas expressed by others.	3. Plan and draft texts, and revise and edit in response to suggestions expressed by others about such aspects as ideas, organization, style, and word choice.	3. Plan and draft texts, and revise and edit their own writing, and help others revise and edit their texts in such areas as content, perspective, and effect.	3. Plan, draft, revise, and edit their texts, and analyze and critique the texts of others in such areas as purpose, effectiveness, cohesion, and creativity.
4. Begin to edit text and discuss language conventions using appropriate terms. Examples include action words, naming words, capital letters, and periods.	4. Identify multiple language conventions and use them when editing text. Examples include recognition of nouns, verbs, and modifiers, capitalization rules, punctuation marks, and spelling.	4. Select and use appropriate language conventions when editing text. Examples include various grammatical constructions, subject-verb agreement, punctuation, and spelling.	4. Demonstrate precision in selecting appropriate language conventions when editing text. Examples include complex grammatical constructions, sentence structures, punctuation, and spelling.

Content Standard 3: All students will focus on meaning and communication as they listen, speak, view, read, and write in personal, social, occupational, and civic contexts.

Early Elementary	Later Elementary	Middle School	High School
1. Integrate listening, speaking, viewing, reading, and writing skills for multiple purposes and in varied contexts. Examples include using more than one of the language arts to create a story, write a poem or letter, or to prepare and present a unit project on their community.	1. Integrate listening, speaking, viewing, reading, and writing skills for multiple purposes and in varied contexts. An example is using all the language arts to prepare and present a unit project on a selected state or country.	1. Integrate listening, viewing, speaking, reading, and writing skills for multiple purposes and in varied contexts. An example is using all the language arts to prepare and present a unit project on career exploration.	1. Integrate listening, viewing, speaking, reading, and writing skills for multiple purposes and in varied contexts. An example is using all the language arts to complete and present a multi-media project on a national or international issue.
2. Explore the relationships among various components of the communication process such as sender, message, and receiver. An example is understanding how the source of the message affects the receiver's response.	2. Analyze the impact of variables on components of the communication process. Examples include the impact of background noise on an oral message and the effect of text errors, such as spelling or grammar, on the receiver.	2. Begin to implement strategies to regulate effects of variables of the communication process. An example is selecting a format for the message to influence the receiver's response.	2. Consistently use strategies to regulate the effects of variables on the communication process. An example is designing a communication environment for maximum impact on the receiver.
3. Read and write with developing fluency, speak confidently, listen and interact appropriately, view strategically, and represent creatively. Examples include sharing texts in groups and using an author's/reader's chair.	3. Read and write fluently, speak confidently, listen and interact appropriately, view knowledgeably, and represent creatively. Examples include exploring ideas in a group, interviewing family and friends, and explaining ideas represented in pictures.	3. Read and write fluently, speak confidently, listen and interact appropriately, view critically, and represent creatively. Examples include reporting formally to an audience, debating issues, and interviewing members of the public.	3. Read and write fluently, speak confidently, listen and interact appropriately, view critically, and represent creatively. Examples include speaking publicly, demonstrating teamwork skills, debating formally, performing literature, and interviewing for employment.
4. Describe and use effective listening and speaking behaviors that enhance verbal communication and facilitate the construction of meaning. Examples include use of gestures and appropriate group behavior.	4. Distinguish between verbal and nonverbal communication, and identify and practice elements of effective listening and speaking. Examples include recognizing the impact of variations of facial expression, posture, and volume on oral communication.	4. Practice verbal and nonverbal strategies that enhance understanding of spoken messages and promote effective listening behaviors. Examples include altering inflection, volume, and rate, using evidence, and reasoning.	4. Consistently use effective listening strategies (e.g., discriminating, assigning meaning, evaluating, and remembering) and elements of effective speaking (e.g., message content, language choices, and audience analysis).

5. Employ strategies to construct meaning while reading, listening to, viewing, or creating texts. Examples include retelling, predicting, generating questions, examining picture cues, discussing with peers, using context clues, and creating mental pictures.

6. Determine the meaning of unfamiliar words and concepts in oral, visual, and written texts by using a variety of resources, such as prior knowledge, context, other people, dictionaries, pictures, and electronic sources.

7. Recognize that creators of texts make choices when constructing text to convey meaning, express feelings, and influence an audience. Examples include word selection, sentence length, and use of illustrations.

8. Respond to the ideas or feelings generated by texts and listen to the responses of others.

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5. Employ multiple strategies to construct meaning while reading, listening to, viewing, or creating texts. Examples include summarizing, predicting, generating questions, mapping, examining picture cues, analyzing word structure and sentence structure, discussing with peers, and using context and text structure.

6. Determine the meaning of unfamiliar words and concepts in oral, visual, and written texts by using a variety of resources, such as prior knowledge, context, glossaries, and electronic sources.

7. Recognize and use texts as models and employ varied techniques to construct text, convey meaning, and express feelings to influence an audience. Examples include effective introductions and conclusions, different points of view, and rich descriptions.

8. Express their responses to oral, visual, written, and electronic texts, and compare their responses to those of others.

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5. Select appropriate strategies to construct meaning while reading, listening to, viewing, or creating texts. Examples include generating relevant questions, studying vocabulary, analyzing mood and tone, recognizing how authors and speakers use information, and matching form to content.

6. Determine the meaning of unfamiliar words and concepts in oral, visual, and written texts by using a variety of resources, such as semantic and structural features, prior knowledge, reference materials, and electronic sources.

7. Recognize and use varied techniques to construct text, convey meaning, and express feelings to influence an audience. Examples include identification with characters and multiple points of view.

8. Express their responses and make connections between oral, visual, written, and electronic texts and their own lives.

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5. Employ the most effective strategies to construct meaning while reading, listening to, viewing, or creating texts. Examples include generating focus questions; deciding how to represent content through analyzing, clustering, and mapping; and withholding personal bias while listening.

6. Determine the meaning of specialized vocabulary and concepts in oral, visual, and written texts by using a variety of resources, such as context, research, reference materials, and electronic sources.

7. Recognize and use varied innovative techniques to construct text, convey meaning, and express feelings to influence an audience. Examples include experimentation with time, order, stream of consciousness, and multiple points of view.

8. Analyze their responses to oral, visual, written, and electronic texts, providing examples of how texts affect their lives, connect them with the contemporary world, and transmit issues across time.

LANGUAGE

Content Standard 4: All students will use the English language effectively.

Early Elementary	Later Elementary	Middle School	High School
1. Demonstrate awareness of differences in language patterns used in their spoken, written, and visual communication contexts, such as the home, playground, classroom, and storybooks.	1. Describe language patterns used in their spoken, written, and visual communication contexts, such as school, neighborhood, sports, children's periodicals, and hobbies.	1. Compare and contrast spoken, written, and visual language patterns used in their communication contexts, such as community activities, discussions, mathematics and science classes, and the workplace.	1. Demonstrate how language usage is related to successful communication in their different spoken, written, and visual communication contexts, such as job interviews, public speeches, debates, and advertising.
2. Explore and discuss how languages and language patterns vary from place to place and how these languages and dialects are used to convey ideas and feelings. An example is comparing a television toy ad to a print toy ad.	2. Describe how features of English, such as language patterns and spelling, vary over time and from place to place and how they affect meaning in formal and informal situations. An example is exploring regional language variations in the United States.	2. Investigate the origins of language patterns and vocabularies and their impact on meaning in formal and informal situations. An example is comparing language in a business letter to language in a friendly letter.	2. Use an understanding of how language patterns and vocabularies transmit culture and affect meaning in formal and informal situations. An example is identifying distinctions in the verbal and non-verbal communication behaviors of national or world leaders.
3. Demonstrate awareness of words that have entered the English language from many cultures.	3. Begin to recognize how words and phrases relate to their origin. Examples include surnames and names of bodies of water or landmarks.	3. Investigate idiomatic phrases and word origins and how they have contributed to contemporary meaning.	3. Explore and explain how the same words can have different usages and meanings in different contexts, cultures, and communities.
4. Become aware of and begin to experiment with different ways to express the same idea.	4. Explore how words normally considered synonyms can carry different connotations when used in a variety of spoken and written texts.	4. Demonstrate how communication is affected by connotation and denotation and why one particular word is more effective or appropriate than others in a given context.	4. Demonstrate ways in which communication can be influenced through word usage. Examples include propaganda, irony, parody, and satire.

Early Elementary	Later Elementary	Middle School	High School
5. Explore and begin to use language appropriate for different contexts and purposes. Examples include community building, story discussions, casual conversations, writing workshops, science lessons, playground games, thank-you letters, and daily conversations.	5. Recognize and use language appropriate for varied contexts and purposes. Examples include community building, mathematics class, team sports, friendly and formal letters or invitations, requests for information, interviews with adults, and significant discussions.	5. Recognize and use levels of discourse appropriate for varied contexts, purposes, and audiences, including terminology specific to a particular field. Examples include community building, an explanation of a biological concept, comparison of computer programs, commentary on an artistic work, analysis of a fitness program, and classroom debates on political issues.	5. Recognize and use levels of discourse appropriate for varied contexts, purposes, and audiences, including terminology specific to particular fields. Examples include community building, presentations integrating different disciplines, lessons comparing fields of study, promotional material created for an interdisciplinary project, and videos designed to inform or entertain diverse audiences.

LITERATURE

Content Standard 5: All students will read and analyze a wide variety of classic and contemporary literature and other texts to seek information, ideas, enjoyment, and understanding of their individuality, our common heritage and common humanity, and the rich diversity in our society.

Early Elementary	Later Elementary	Middle School	High School
1. Select, read, listen to, view, and respond thoughtfully to both classic and contemporary texts recognized for quality and literary merit.	1. Select, read, listen to, view, and respond thoughtfully to both classic and contemporary texts recognized for quality and literary merit.	1. Select, read, listen to, view, and respond thoughtfully to both classic and contemporary texts recognized for quality and literary merit.	1. Select, read, listen to, view, and respond thoughtfully to both classic and contemporary texts recognized for quality and literary merit.
2. Describe and discuss the similarities of plot and character in literature and other texts from around the world.	2. Describe and discuss the shared human experiences depicted in literature and other texts from around the world. Examples include birth, death, heroism, and love.	2. Describe and discuss shared issues in the human experience that appear in literature and other texts from around the world. Examples include quests for happiness and service to others.	2. Describe and discuss archetypal human experiences that appear in literature and other texts from around the world.
3. Describe how characters in literature and other texts can represent members of several different communities.	3. Demonstrate awareness that characters and communities in literature and other texts reflect life by portraying both positive and negative images.	3. Identify and discuss how the tensions among characters, communities, themes, and issues in literature and other texts are related to one's own experience.	3. Analyze how the tensions among characters, communities, themes, and issues in literature and other texts reflect the substance of the human experience.

4. Recognize the representation of various cultures as well as our common heritage in literature and other texts.	4. Describe how various cultures and our common heritage are represented in literature and other texts.	4. Investigate and demonstrate understanding of the cultural and historical contexts of the themes, issues, and our common heritage as depicted in literature and other texts.	4. Analyze how cultures interact with one another in literature and other texts, and describe the consequences of the interaction as it relates to our common heritage.
5. Explain how characters in literature and other texts express attitudes about one another.	5. Describe how characters in literature and other texts form opinions about one another in ways that can be fair and unfair.	5. Investigate through literature and other texts various examples of distortion and stereotypes. Examples include those associated with gender, race, culture, age, class, religion, and handicapping conditions.	5. Analyze and evaluate the authenticity of the portrayal of various societies and cultures in literature and other texts. An example is critiquing print and non-print accounts of historical and contemporary social issues.

VOICE

Content Standard 6: All students will learn to communicate information accurately and effectively and demonstrate their expressive abilities by creating oral, written, and visual texts that enlighten and engage an audience.

Early Elementary	Later Elementary	Middle School	High School
1. Identify elements of effective communication that influence the quality of their interactions with others. Examples include use of facial expression, word choice, and articulation.	1. Practice using elements of effective communication to enhance their relationships in their school and communities. Examples include enunciation of terms, use of humor, and use of emphasis.	1. Analyze their use of elements of effective communication that impact their relationships in their schools, families, and communities. Examples include use of pauses, suspense, and elaboration.	1. Assess their use of elements of effective communication in personal, social, occupational, and civic contexts. Examples include use of pacing, repetition, and emotion.
2. Experiment with the various voices they use when they speak and write for different purposes and audiences.	2. Explain the importance of developing confidence and a unique presence or voice in their own oral and written communication.	2. Demonstrate their ability to use different voices in oral and written communication to persuade, inform, entertain, and inspire their audiences.	2. Evaluate the power of using multiple voices in their oral and written communication to persuade, inform, entertain, and inspire their audiences.
3. Explore works of different authors, speakers, and illustrators to determine how they present ideas and feelings to evoke different responses.	3. Identify the style and characteristics of individual authors, speakers, and illustrators and how they shape text and influence their audiences' expectations.	3. Compare and contrast the style and characteristics of individual authors, speakers, and illustrators and how they shape text and influence their audiences' expectations.	3. Analyze the style and characteristics of authors, actors, and artists of classics and masterpieces to determine why these voices endure.

4. Develop a sense of personal voice by explaining their selection of materials for different purposes and audiences. Examples include portfolios, displays, and literacy interviews.	4. Reveal personal voice by explaining growth in learning and accomplishment through their selection of materials for different purposes and audiences. Examples include portfolios, displays, literacy interviews, and submissions for publications.	4. Document and enhance a developing voice through multiple media. Examples include reflections for their portfolios, audio and video tapes, and submissions for publications.	4. Document and enhance a developing voice with authentic writings for different audiences and purposes. Examples include portfolios, video productions, submissions for competitions or publications, individual introspections, and applications for employment and higher education.

SKILLS AND PROCESSES

Content Standard 7: All students will demonstrate, analyze, and reflect upon the skills and processes used to communicate through listening, speaking, viewing, reading, and writing.

Early Elementary	Later Elementary	Middle School	High School
1. Use a combination of strategies when encountering unfamiliar texts while constructing meaning. Examples include retelling, predicting, generating questions, examining picture cues, analyzing phonetically, discussing with peers, and using text cues.	1. Use a combination of strategies when encountering unfamiliar texts while constructing meaning. Examples include retelling, predicting, generating questions, mapping, examining picture cues, analyzing word structure, discussing with peers, analyzing phonetically, and using context and text structure.	1. Use a combination of strategies when encountering unfamiliar texts while constructing meaning. Examples include generating questions, studying vocabulary, analyzing mood and tone, recognizing how creators of text use and represent information, and matching form to content.	1. Use a combination of strategies when encountering unfamiliar texts while constructing meaning. Examples include generating questions; scanning for specific information related to research questions; analyzing tone and voice; and representing content through summarizing, clustering, and mapping.
2. Monitor their progress while beginning to use a variety of strategies to overcome difficulties when constructing and conveying meaning.	2. Monitor their progress while using a variety of strategies to overcome difficulties when constructing and conveying meaning.	2. Monitor their progress while using a variety of strategies to overcome difficulties when constructing and conveying meaning, and develop strategies to deal with new communication needs.	2. Monitor their progress while using a variety of strategies to overcome difficulties when constructing and conveying meaning, and demonstrate flexible use of strategies across a wide range of situations.
3. Reflect on their emerging literacy, set goals, and make appropriate choices throughout the learning process as they develop the ability to regulate their learning.	3. Apply new learning by forming questions and setting learning goals that will aid in self-regulation and reflection on their developing literacy.	3. Reflect on their own developing literacy, set learning goals, and evaluate their progress.	3. Reflect on their understanding of literacy, assess their developing ability, set personal learning goals, create strategies for attaining those goals, and take responsibility for their literacy development.

4. Begin to develop and use strategies for planning, drafting, revising, and editing a variety of text forms. Examples include identifying characteristics of their audience, mapping, and proofreading.	4. Develop and use a variety of strategies for planning, drafting, revising, and editing different forms of texts for specific purposes. Examples include brainstorming, revising with peers, sensitivity to audience, and strategies appropriate for purposes, such as informing, persuading, entertaining, and inspiring.	4. Demonstrate a variety of strategies for planning, drafting, revising, and editing several different forms of texts for specific purposes. Examples include persuading a particular audience to take action and capturing feelings through poetry.	4. Demonstrate flexibility in using strategies for planning, drafting, revising, and editing complex texts in a variety of genre, and describe the relationship between form and meaning. Examples include preparing text for publication and presentation and using strategies appropriate for purposes, such as editorializing an opinion, and developing and justifying a personal perspective on a controversial issue.

GENRE AND CRAFT OF LANGUAGE

Content Standard 8: All students will explore and use the characteristics of different types of texts, aesthetic elements, and mechanics—including text structure, figurative and descriptive language, spelling, punctuation, and grammar—to construct and convey meaning.

Early Elementary	Later Elementary	Middle School	High School
1. Identify and use mechanics that enhance and clarify understanding. Examples include using conventional punctuation, capitalization, and spelling, as well as approximations of conventional spelling, and restating key ideas in oral messages.	1. Identify and use mechanics that enhance and clarify understanding. Examples include sentence structure, paragraphing, appropriate punctuation, grammatical constructions, conventional spelling, and relating in sequence an account of an oral or visual experience.	1. Select and use mechanics that enhance and clarify understanding. Examples include paragraphing, organizational patterns, variety in sentence structure, appropriate punctuation, grammatical constructions, conventional spelling, and the use of connective devices, such as previews and reviews.	1. Identify and use selectively mechanics that facilitate understanding. Examples include organizational patterns, documentation of sources, appropriate punctuation, grammatical constructions, conventional spelling, and the use of connective devices, such as transitions and paraphrasing an oral message completely and accurately.
2. Explore how the characteristics of various narrative genre and story elements can be used to convey ideas and perspectives. Examples include character, setting, and problem in poetry, drama, and folktales.	2. Identify and use elements of various narrative genre and story elements to convey ideas and perspectives. Examples include theme, plot, conflict, and characterization in poetry, drama, story telling, historical fiction, mystery, and fantasy.	2. Describe and use characteristics of various narrative genre and elements of narrative technique to convey ideas and perspectives. Examples include foreshadowing and flashback in poetry, science fiction, short stories, and novels.	2. Describe and use characteristics of various narrative genre and complex elements of narrative technique to convey ideas and perspectives. Examples include use of symbol, motifs, and function of minor characters in epics, satire, and drama.

3. Explore how the characteristics of various informational genre (e.g., show-and-tell, trade books, textbooks, and dictionaries) and elements of expository text structure (e.g., organizational patterns, major ideas, and details) can be used to convey ideas.

3. Identify and use characteristics of various informational genre (e.g., periodicals, public television programs, textbooks, and encyclopedias) and elements of expository text structure (e.g., organizational patterns, supporting details, and major ideas) to convey ideas.

3. Describe and use characteristics of various informational genre (e.g., biographies, newspapers, brochures, and persuasive arguments and essays) and elements of expository text structure (e.g., multiple patterns of organization, relational links, and central purposes) to convey ideas.

3. Describe and use characteristics of informational genre (e.g., manuals, briefings, documentaries, and research presentations) and complex elements of expository texts (e.g., thesis statement, supporting ideas, and authoritative and/or statistical evidence) to convey ideas.

4. Identify and use aspects of the craft of the speaker, writer, and illustrator to formulate and express their ideas artistically. Examples include dialogue, characterization, conflict, organization, diction, color, and shape.

4. Identify and use aspects of the craft of the speaker, writer, and illustrator to formulate and express their ideas artistically. Examples include intonation, hues, design, perspective, dialogue, characterization, metaphor, simile, and points of view.

4. Identify and use aspects of the craft of the speaker, writer, and illustrator to formulate and express their ideas artistically. Examples include color and composition, flashback, multi-dimensional characters, pacing, appropriate use of details, strong verbs, language that inspires, and effective leads.

4. Identify and use aspects of the craft of the speaker, writer, and illustrator to formulate and express their ideas artistically. Examples include imagery, irony, multiple points of view, complex dialogue, aesthetics, and persuasive techniques.

5. Explore how the characteristics of various oral, visual, and written texts (e.g., videos, CD-ROM stories, books on tape, and trade books) and the textual aids they employ (e.g., illustrations, tables of contents, and headings/titles) are used to convey meaning.

5. Describe and use the characteristics of various oral, visual, and written texts (e.g., films, library databases, atlases, and speeches) and the textual aids they employ (e.g., footnotes, menus, addresses, graphs, and figures) to convey meaning.

5. Explain how the characteristics of various oral, visual, and written texts (e.g., videos, hypertext, glossaries, textbooks, and speeches) and the textual aids they employ (e.g., subheadings/titles, charts, and indexes) are used to convey meaning.

5. Describe and use the characteristics of various oral, visual, and written texts (e.g., debate, drama, primary documents, and documentaries) and the textual aids they employ (e.g., prefaces, appendices, lighting effects, and microfiche headings) to convey meaning and inspire audiences.

DEPTH OF UNDERSTANDING

Content Standard 9: All students will demonstrate understanding of the complexity of enduring issues and recurring problems by making connections and generating themes within and across texts.

Early Elementary	Later Elementary	Middle School	High School
1. Explore and reflect on universal themes and substantive issues from oral, visual, and written texts. Examples include new friendships and life in the neighborhood.	1. Explore and reflect on universal themes and substantive issues from oral, visual, and written texts. Examples include exploration, discovery, and formation of personal relationships.	1. Explore and reflect on universal themes and substantive issues from oral, visual, and written texts. Examples include coming of age, rights and responsibilities, group and individual roles, conflict and cooperation, creativity, and resourcefulness.	1. Analyze and reflect on universal themes and substantive issues from oral, visual, and written texts. Examples include human interaction with the environment, conflict and change, relationships with others, and self-discovery.
2. Identify and categorize key ideas, concepts, and perspectives found in texts.	2. Draw parallels and contrasts among key ideas, concepts, and varied perspectives found in multiple texts.	2. Synthesize content from multiple texts representing varied perspectives in order to formulate principles and generalizations.	2. Synthesize from multiple texts representing varied perspectives, and apply the principles and generalizations needed to investigate and confront complex issues and problems.
3. Draw conclusions based on their understanding of differing views presented in text.	3. Use conclusions based on their understanding of differing views presented in text to support a position.	3. Develop a thesis using key concepts, supporting evidence, and logical argument.	3. Develop and extend a thesis by analyzing differing perspectives and resolving inconsistencies in logic in order to support a position.

IDEAS IN ACTION

Content Standard 10: All students will apply knowledge, ideas, and issues drawn from texts to their lives and the lives of others.

Early Elementary	Later Elementary	Middle School	High School
1. Make connections between key ideas in literature and other texts and their own lives.	1. Identify how their own experiences influence their understanding of key ideas in literature and other texts.	1. Analyze themes and central ideas in literature and other texts in relation to issues in their own lives.	1. Use themes and central ideas in literature and other texts to generate solutions to problems and formulate perspectives on issues in their own lives.

2. Demonstrate their developing literacy by using text to enhance their daily lives. Examples include reading with a parent, discussing a favorite text, writing to a friend or relative about an experience, and creating a visual representation of an important idea.	2. Combine skills to reveal their strengthening literacy. Examples include writing and illustrating a text, reading and then orally analyzing a text, and listening to and then summarizing a presentation.	2. Perform the daily functions of a literate individual. Examples include acquiring information from multiple sources and then evaluating, organizing, and communicating it in various contexts.	2. Function as literate individuals in varied contexts within their lives in and beyond the classroom. Examples include using text resources while thinking creatively, making decisions, solving problems, and reasoning in complex situations.
3. Use oral, written, and visual texts to identify and explore school and community issues and problems, and discuss how one individual or group can make a difference. Examples include responding orally, artistically, or in writing about an issue or problem they have studied and/or experienced.	3. Use oral, written, and visual texts to research how individuals have had an impact on people in their community and their nation. Examples include creating texts to inform others about school or community issues and problems.	3. Use oral, written, and visual texts to identify and research issues of importance that confront adolescents, their community, their nation, and the world. Examples include using research findings to organize and create texts to persuade others to take a particular position or to alter their course of action with regard to a particular school/community issue or problem.	3. Utilize the persuasive power of text as an instrument of change in their community, their nation, and the world. Examples include identifying a community issue and designing an authentic project using oral, written, and visual texts to promote social action.

INQUIRY AND RESEARCH

Content Standard 11: All students will define and investigate important issues and problems using a variety of resources, including technology, to explore and create texts.

Early Elementary	Later Elementary	Middle School	High School
Generate questions about important issues that affect them or topics about which they are curious, and use discussion to narrow questions for further exploration.	1. Generate questions about important issues that affect them or topics about which they are curious, and use discussion to narrow questions for research.	1. Generate questions about important issues that affect them or topics about which they are curious; narrow the questions to a clear focus; and create a thesis or a hypothesis.	1. Generate questions about important issues that affect them or society, or topics about which they are curious; narrow the questions to a clear focus; and create a thesis or a hypothesis.

2. Identify and use resources that are most appropriate and readily available for investigating a particular question or topic. Examples include knowledgeable people, field trips, library classification systems, encyclopedias, atlases, word processing programs, and electronic media.	2. Identify and use the kinds of resources that are most useful and most readily available for the particular questions or topics they wish to investigate. Examples include knowledgeable people, field trips, tables of contents, indexes, glossaries, icons/headings, hypertext, storage addresses, CD-ROM/laser disks, electronic mail, and library catalogue databases.	2. Explain and use resources that are most appropriate and readily available for investigating a particular question or topic. Examples include knowledgeable people, field trips, tables of contents, indexes, glossaries, icons/headings, hypertext, storage addresses, CD-ROM/laser disks, electronic mail, and library catalogue databases.	2. Determine, evaluate, and use resources that are most appropriate and readily available for investigating a particular question or topic. Examples include knowledgeable people, field trips, prefaces, appendices, icons/headings, hypertext, menus and addresses, Internet and electronic mail, CD-ROM/laser disks, microfiche, and library and interlibrary catalogue databases.
3. Organize and interpret information to draw conclusions based on the investigation of an issue or problem.	3. Organize and analyze information to draw conclusions and implications based on their investigation of an issue or problem.	3. Organize, analyze, and synthesize information to draw conclusions and implications based on their investigation of an issue or problem.	3. Synthesize and evaluate information to draw conclusions and implications based on their investigation of an issue or problem.
4. Develop and present conclusions based on the investigation of an issue or problem. Examples include skits, plays, songs, and personal or creative stories.	4. Using multiple media, develop and present a short presentation to communicate conclusions based on the investigation of an issue or problem. Examples include charts, posters, transparencies, audio tapes, videos, and diagrams.	4. Use different means of developing and presenting conclusions based on the investigation of an issue or problem to an identified audience. Examples include election ballots, hypertext, and magazines and booklets including graphics.	4. Research and select the medium and format to be used to present conclusions based on the investigation of an issue or problem. Examples include satire, parody, multimedia presentations, plays, and mock trials.

CRITICAL STANDARDS

Content Standard 12: All students will develop and apply personal, shared, and academic criteria for the enjoyment, appreciation, and evaluation of their own and others' oral, written, and visual texts.

Early Elementary	Later Elementary	Middle School	High School
1. Identify the qualities of their own oral, visual, and written texts that help them communicate effectively for different purposes. Examples include content, styles, and organizational devices, such as the use of a chronological sequence in the telling of a story.	1. Develop individual standards for effective communication for different purposes, and compare them to their own oral, visual, and written texts. An example is evaluating a project report in terms of personal standards for content, style, and organization.	1. Differentiate sets of standards for individual use according to the purpose of the communication context. An example is maintaining different sets of individual standards when creating texts for formal and informal situations.	1. Apply sets of standards for individual use according to the purpose of the communication context. An example is comparing and contrasting standards in the evaluation of a popular movie, television program, article, or presentation on the same topic.

2. Discuss individual and shared standards used for different purposes.

2. Develop and apply both individual and shared standards based on exemplary works created for varied purposes and contexts.

2. Demonstrate understanding of individual, shared, and academic standards used for different purposes and contexts.

2. Analyze and apply individual, shared, and academic standards in various contexts.

3. Discuss choices in reading, writing, speaking, listening, viewing, and representing that reflect aesthetic qualities, such as rhyme, rhythm of the language, or repetition.

3. Demonstrate preferences in reading, writing, speaking, listening, viewing, and representing based on aesthetic qualities, and explain their choices.

3. Develop critical standards based on aesthetic qualities, and use them to explain choices in reading, writing, speaking, listening, viewing, and representing.

3. Use literary history, tradition, theory, terminology, and other critical standards to develop and justify judgments about the craft and significance of oral, visual, and written texts.

4. Create a collection of personal work selected according to both individual and shared criteria, reflecting on the merit of each selection.

4. Create a collection of personal work selected according to both individual and shared criteria, judging the merit of each selection.

4. Create a collection of personal work based on individual, shared, and academic standards, reflecting on the merit of each selection.

4. Create a collection of personal work based on individual, shared, and academic standards, justifying judgments about the craft and significance of each selection.

5. Recognize that the style and substance of a message reflect the values of a communicator.

5. Develop standards to analyze how the style and substance of personal messages reflect the values of a communicator.

5. Refine their own standards to evaluate personal and public communications within a responsible and ethical system for the expression of ideas.

5. Apply diverse standards (e.g. rhetorical and societal) to evaluate whether a communication is truthful, responsible, and ethical for a specific context.

Social Studies

Vision Statement

Social studies is the integrated study of the social sciences to prepare young people to become responsible citizens. Responsible citizens display social understanding and civic efficacy. Social understanding is knowledge of social aspects of the human condition, how they have evolved over time, the variations that occur in differing physical environments and cultural settings, and the emerging trends that appear likely to shape the future. Civic efficacy is the readiness and willingness to assume citizenship responsibilities and to make informed and reasoned decisions for the public good as citizens of a pluralistic, democratic society in an interdependent world.

A *responsible citizen:*

- uses knowledge of the past to construct meaningful understanding of our diverse cultural heritage and inform her civic judgments (Historical Perspective);

- uses knowledge of spatial patterns on earth to understand processes that shape human environment to make decisions about society (Geographic Perspective);

- uses knowledge of American government and politics to make decisions about governing his community (Civic Perspective);

- use knowledge of the production, distribution and consumption of goods and services to make personal, career and societal decisions about the use of scarce resources (Economic Perspective);

- uses methods of social science investigation to answer questions about society (Inquiry);

- constructs and expresses thoughtful positions on public issues (Public Discourse and Decision Making); and,

- acts constructively to further the public good (Citizen Involvement).

The Purpose of Social Studies

To develop social understanding and civic efficacy, the social studies curriculum builds four capacities in young people: disciplinary knowledge, thinking skills, commitment to democratic values, and citizen participation. Each capacity contributes uniquely to responsible citizenship.

Disciplinary knowledge is used by students to construct meaning through understanding of powerful ideas drawn primarily from the disciplines of history, geography, American government, and economics. The meaning students construct shapes their perspective for understanding society and informs their judgments as citizens.

Thinking skills necessary for effective involvement in public life are practiced and improved within the social studies curriculum. Students use the methods of social science, aided by appropriate technologies, to gather, interpret, and analyze information. Their ability to engage in civic discourse is improved by using the skills of oral and written expression. They also learn to evaluate alternative views when making decisions, both individually and collectively, about matters of public concern.

Respect for the underlying values of a democratic society is developed through effective social studies education. As a result, students comprehend the ideals of democracy, cherish them, and strive to live their lives in accordance with them. A reasoned commitment to democratic values motivates citizens to safeguard their rights, to fulfill their responsibilities as citizens, and to honor the dignity of all people.

Citizen participation experiences stimulate interest in public affairs and strengthen competencies for self-government. Students are encouraged to inform themselves about public affairs and to become active participants in civic life rather than passive bystanders. They are urged to uphold the rule of law in their personal and social lives and to challenge wrongdoing. Efforts to advance their views about local, national, and international policy through political action are supported by the curriculum. Through service learning, the social studies curriculum equips students to improve their communities and to realize the civic virtue of serving.

Social studies education for responsible citizenship is a compelling priority if we expect to sustain our constitutional democracy. Young people must be educated to understand the complexities of human society and to govern themselves competently. It is upon these pillars that responsible citizenship rests.

Overview of the Social Studies Content Strands
The social studies curriculum should be designed so that students meet 25 standards that are indicators of responsible citizenship. These standards, expressed as attributes we envision for our graduates, are the intended results of students' experience with the curriculum. Students make continuous progress toward meeting the standards at each level of schooling. All of the standards are pursued at every grade level of the curriculum from kindergarten to graduation. Although the standards refer to areas of knowledge and skill that no one ever masters completely in a total sense, benchmarks are established for each to designate clearly what students are expected to know and be able to do by the end of the primary grades, the upper elementary grades, middle school, and high school. This part of the framework introduces the standards. The social studies standards are grouped into seven broad categories called strands.

Strand I. Historical Perspective
Students use knowledge of the past to construct meaningful understanding of our diverse cultural heritage and to inform their civic judgments.

A rich historical perspective begins with knowledge of significant events, ideas, and actors from the past. That knowledge encompasses both our commonalities and our diversity exemplified by race, ethnicity, social and economic status, gender, region, politics, and religion. Meaningful understanding of the past involves the integration of historical knowledge and thinking skills. Neither historical knowledge nor thinking develops independently of the other. If our decisions in contemporary life are to be guided by knowledge of the past, we must learn to engage in historical reasoning, to think through cause-effect relationships, to reach sound historical interpretations, and to conduct historical inquiries. Over time and in varying contexts, students develop an increasingly sophisticated historical perspective by drawing upon the following fields of historical thinking:

Standard I.I Time and Chronology
All students will sequence chronologically the following eras of American History and key events within these eras in order to examine relationships and to explain cause and effect: The Meeting of Three Worlds (beginnings to 1620); Colonization and Settlement (1585-1763); Revolution and the New Nation (1754-1815); Expansion and Reform (1801-1861); and Civil War and Reconstruction (1850-1877); The Development of the Industrial United States (1870-1900); The Emergence of Modern America (1890-1930); The Great Depression and World War II (1929-1945); Post War United States (1945-1970); and Contemporary United States (1968-present).

Chronological thinking is at the very heart of historical reasoning. Without a clear sense of historical time we are bound to see events as one great tangled mess. Events must be sequenced in time in order to examine relationships among them or to explain cause and effect.

Standard I.2 Comprehending the Past
All students will understand narratives about major eras of American and world history by identifying the people involved, describing the setting, and sequencing the events.

Reading accounts of human events with understanding requires recognition of chronological sequence—the beginning, middle, and end of a story. Comprehension also requires identification of the characters involved, the situation or setting in which the narrative takes place, and the sequence of events through which the story unfolds, including the initiating event(s) and the results.

Standard I.3 Analyzing and Interpreting the Past
All students will reconstruct the past by comparing interpretations written by others from a variety of perspectives and creating narratives from evidence.

History is not a succession of facts marching to a settled conclusion. Written history is a human construction and conclusions about the past are tentative and arguable. Documents, eyewitness accounts, letters, diaries, artifacts, photos, historical sites, and other fragments of the past are subject to analysis and interpretation. Credible reconstruction

of the past draws upon a variety of records and compares interpretations that reveal more than one perspective on events. One can engage in "doing history" by assessing historical narratives written by others or by creating a narrative from evidence that has been compiled, analyzed, and interpreted.

Standard I.4 Judging Decisions from the Past
All students will evaluate key decisions made at critical turning points in history by assessing their implications and long-term consequences.

At critical turning points in history, we sometimes encounter key decisions that were made at the time. By entering personally into such moments, we can confront important issues of an era. When revisiting these issues, we can analyze the interests and values held by those caught up in the situation, consider alternative choices and their consequences, assess the ethical implications of possible decisions, and evaluate the decision made in light of its long-term consequences revealed in the historical record.

Strand II. Geographic Perspective
Students will use knowledge of spatial patterns on earth to understand processes that shape human environments and to make decisions about society.

Knowledge of geography enables us to analyze both the physical features and the cultural aspects of our world. By helping us understand relationships within and between places, a geographic perspective brings an understanding of interdependence within local, national, and global communities. Over time and in varying contexts, students construct an increasingly sophisticated geographic perspective organized by the following themes:

Standard II.I Diversity of People, Places, and Cultures
All students will describe, compare, and explain the locations and characteristics of places, cultures, and settlements.

The mosaic of people, places, and cultures expresses the rich variety of the earth. Natural and human characteristics meld to form expressions of cultural uniqueness, as well as similarities among peoples. Culture is the way of life of a group of people including language, religion, traditions, family structure, institutions, and economic activities.

Standard II.2 Human/Environment Interaction
All students will describe, compare, and explain the locations and characteristics of ecosystems, resources, human adaptation, environmental impact, and the interrelationships among them.

Understanding human/environment interaction enables one to consider how people rely on the environment, how they alter it, how it may limit what they are able to do, and the consequences of actions for both people and the natural environment.

Standard II.3 Location, Movement, and Connections
All students will describe, compare, and explain the locations and characteristics of economic activities, trade, political activities, migration, information flow, and the interrelationships among them.

Locations are connected by different transportation and communication networks that channel the movement of people, goods, and information. Location of places along the networks is important in analyzing why some places are different in size and complexity from other places, what connections have developed, why movement occurs, and the consequences of different types of movement.

Standard II.4 Regions, Patterns, and Processes
All students will describe and compare characteristics of ecosystems, states, regions, countries, major world regions, and patterns and explain the processes that created them.

The world can be viewed systematically or regionally. Climatic, economic, political, and cultural patterns are created by processes such as climatic systems, communication networks, international trade, political systems, and population changes. A region is an area with unifying characteristics. By defining regions, we are able to divide the world into parts in order to study their uniqueness and relationships.

Standard II.5 Global Issues and Events
All students will describe and explain the causes, consequences, and geographic context of major global issues and events.

Places are interconnected by global processes. Throughout the world, people are increasingly linked by physical and human systems. Interdependence can be understood through the study of events that have significance beyond regional or national boundaries.

Strand III. Civic Perspective
Students will use knowledge of American government and politics to make informed decisions about governing their communities.

Knowledge of government enables individuals to define the roles of citizens within a constitutional democracy and to compare the American system of government with other systems. Civic knowledge builds understanding about the exercise of power. With knowledge of government and politics, citizens are equipped to evaluate domestic and international policy and to exert influence in public affairs. Over time and in varying contexts, students construct an increasingly sophisticated civic perspective organized by the following themes:

Standard III.I Purposes of Government
All students will identify the purposes of national, state, and local governments in the United States, describe how citizens organize government to accomplish their purposes and assess their effectiveness.

All societies establish governments to serve intended purposes. The purposes served by a government and the priorities set have significant consequences for the individual and society. In order to accomplish their purposes, governments organize themselves in different ways.

Standard III.2 Ideals of American Democracy
All students will explain the meaning and origin of the ideas, including the core democratic values expressed in the Declaration of Independence, the Constitution, and other foundational documents of the United States.

American constitutional democracy is founded on a core set of values expressed in the nation's foundational documents. A shared commitment to these values bonds Americans with a common identity and provides social cohesion. Political and legal processes are created to clarify the meaning of values in the American creed and to resolve conflicts among those values.

Standard III.3 Democracy in Action
All students will describe the political and legal processes created to make decisions, seek consensus, and resolve conflicts in a free society.

In a free society, there are inevitable conflicts that arise from the clash of various interests, perceptions, and beliefs. Responsible citizens learn to confront these conflicts and to work toward resolving them within the boundaries of democratic procedures.

Standard III.4 American Government and Politics
All students will explain how American governmental institutions at the local, state, and federal levels provide for the limitation and sharing of power and how the nation's political system provides for the exercise of power.

The American system of government is based on shared power. Citizens who operate effectively within the federal system understand its institutions and how to work within them.

Standard III.5 American Government and World Affairs
All students will understand how the world is organized politically, the formation of American foreign policy, and the roles the United States plays in the international arena.

The United States is part of an interconnected world which requires citizens to understand how the world is organized politically, the process by which foreign policy is formulated, and the roles that our nation plays in the international arena.

Strand IV. Economic Perspective
Students will use knowledge of the production, distribution, and consumption of goods and services to make personal and societal decisions about the use of scarce resources.

Knowledge of economics enables us to understand and consider potential implications of the basic scarcity problem faced by all societies: unlimited wants in pursuit of limited resources. This problem requires economic decisions on matters ranging from

personal finance to international trade. Each decision involves both short- and long-term benefits as well as costs. When we act upon our choice, the loss of the next best alternative is our opportunity cost. Individuals, households, businesses, and governments all face choices in attempting to satisfy unlimited wants from scarce resources. Successful economic decisions require a thorough examination of alternative choices and the anticipation of both intended and unintended consequences.

Standard IV.1 Individual and Household Choices

All students will describe and demonstrate how the economic forces of scarcity and choice affect the management of personal financial resources, shape consumer decisions regarding the purchase, use, and disposal of goods and services, and affect the economic well-being of individuals and society.

The quality of individual decision-making is crucial to the effective operation of the economic system and to the personal well-being of its members. Consumer decisions regarding the purchase, use, and disposal of goods and services are shaped by economic forces. As workers, consumers, savers, and investors, individuals confront scarcity and the opportunity costs (loss of the next best alternative) of their choices.

Standard IV.2 Business Choices

All students will explain and demonstrate how businesses confront scarcity and choice when organizing, producing, and using resources, and when supplying the marketplace.

Businesses confront both scarcity and opportunity costs. They make decisions in organizing production, using resources, and supplying the marketplace that have individual and societal consequences. Their choices are affected by the incentives they face and the conditions in which they operate.

Standard IV.3 Role of Government

All students will describe how government decisions on taxation, spending, public goods, and regulation impact what is produced, how it is produced, and who receives the benefits of production.

Government decisions on taxation, spending, public goods, and regulation all impact what is produced, how it is produced, and who receives the benefits of production. Governments also make efforts to resolve economic disputes and problems.

Standard IV.4 Economic systems

All students will explain how a free market economic system works, as well as other economic systems, to coordinate and facilitate the exchange, production, distribution, and consumption of goods and services.

Individuals, businesses, and governments construct systems for producing, distributing, and consuming goods and services. These systems coordinate economic decisions, facilitate exchange, and encourage specialization in the marketplace. They are constantly evolving as we continue to confront scarcity.

Standard IV.5 Trade

All students will describe how trade generates economic development and interdependence and analyze the resulting

challenges and benefits for individuals, producers, and government.

The voluntary exchange of goods, services, and payments between individuals, regions, and nations is the basis for economic development. The resulting interdependence creates both benefits and challenges for individuals, producers, and governments.

Strand V. Inquiry
Students will use methods of social science investigation to answer questions about society.

Inquiry, an essential component of effective decision-making, is the process of investigating problems of significance to society. Some problems can be sufficiently examined through the lens of a single discipline. Other problems, by their very nature, encompass more than one discipline. If citizens are to make sound decisions in efforts to solve social problems, they must learn how to pursue data, think critically, and communicate their findings effectively. Over time and in varying contexts, students will improve their ability to use the following procedures:

Standard V.I Information Processing
All students will acquire information from books, maps, newspapers, data sets, and other sources, organize and present the information in maps, graphs, charts, and time lines, interpret the meaning and significance of information, and use a variety of electronic technologies to assist in accessing and managing information.

The ability to acquire information from books, maps, newspapers, data sets, and other sources, skill in organizing and presenting information in maps, graphs, charts, time lines, and the ability to interpret the meaning and significance of data all continue to be vital skills. In addition, technology has become a critical part of the information age. Students must have experiences in using computers, media, and telecommunication technology to access and process information.

Standard V.2 Conducting Investigations
All students will conduct investigations by formulating a clear statement of a question, gathering and organizing information from a variety of sources, analyzing and interpreting information, formulating and testing hypotheses, reporting results both orally and in writing, and making use of appropriate technology.

Social science investigations usually begin with the clear statement of a question meaningful to the investigator. Gathering and organizing information from a variety of sources, interpreting and analyzing information, formulating and testing of hypotheses, and reporting of results are subsequent steps of the inquiry process. Computers and other electronic technology may be used to access and manage information during an investigation and to report results. Investigations can be carried out by individuals or groups.

Strand VI. Public Discourse and Decision Making

Students will analyze public issues and construct and express thoughtful positions on these issues.

Public issues are unresolved questions of policy that require resolution if people are to govern themselves coherently. They arise in all communities where members make decisions collectively. In order to foster informed consent of the governed, the social studies curriculum engages students in efforts to deliberate local, national, and international public policy issues of enduring importance. Over time and in varying contexts, students improve their ability to produce the following kinds of discourse:

Standard VI.1 Identifying and Analyzing Issues

All students will state an issue clearly as a question of public policy, trace the origins of the issue, analyze various perspectives people bring to the issue, and evaluate possible ways to resolve the issue.

Whether a public issue is local or global in scope, the process of resolution begins by stating the issue clearly as a question of policy. The origins of the issue are then traced: How did it become a matter of disagreement or dispute? In tracing the origins of the issue, various perspectives that people bring to it are acknowledged. Analysis then moves to identifying subordinate ethical, factual, and definitional issues that must be settled in order to resolve the policy issue.

Standard VI.2 Group Discussion

All students will engage their peers in constructive conversation about matters of public concern by clarifying issues, considering opposing views, applying democratic values, anticipating consequences, and working toward making decisions.

In a democratic society, citizens engage one another in face-to-face conversation about matters of public concern stemming from significant past and current events. Through such public talk they clarify issues and work to resolve them by carefully considering opposing views, applying democratic values, and anticipating consequences.

Standard VI.3 Persuasive Writing

All students will compose coherent written essays that express a position on a public issue and justify the position with reasoned arguments.

Coherently composing thoughts about civic issues requires clarification and refinement of thinking. To be persuasive, writing must reflect consideration of alternative perspectives on an issue and express a decision justified with reasoned arguments.

Strand VII. Citizen Involvement

Students will act constructively to further the public good.

To sustain a democratic society, we must produce citizens who are actively involved in public affairs and who regulate their own conduct virtuously. The social studies curriculum

prepares students to participate in political activities, to serve their communities, and to regulate themselves responsibly. Over time and in varying contexts, students will demonstrate the following:

Standard VII.I Responsible Personal Conduct
All students will consider the effects of an individual's actions on other people, how one acts in accordance with the rule of law, and how one acts in a virtuous and ethically responsible way as a member of society.

Responsible citizens address social problems by participating constructively in their communities. They also consider the effects of their actions on other people and they act in accordance with the rule of law to meet their ethical obligations.

SOCIAL STUDIES

CONTENT STANDARDS AND WORKING DRAFT BENCHMARKS

I. Historical Perspective

Content Standard 1: All students will sequence chronologically the following eras of American history and key events within these eras in order to examine relationships and to explain cause and effect: The Meeting of Three Worlds (beginnings to 1620); Colonization and Settlement (1585-1763); Revolution and the New Nation (1754-1815); Expansion and Reform (1801-1861); and Civil War and Reconstruction (1850-1877); The Development of the Industrial United States (1870-1900); The Emergence of Modern America (1890-1930); The Great Depression and World War II (1929-1945); Post War United States (1945-1970); and Contemporary United States (1968-present). (Time and Chronology).

Early Elementary	Later Elementary	Middle School	High School
1. Use analog and digital clocks to tell time.	1. Measure chronological time by decades and centuries.	1. Construct and interpret timelines of people and events from the history of Michigan and the United States through the era of Reconstruction and from the history of other regions of the world.	1. Construct and interpret timelines of people and events in the history of Michigan and the United States since the era of Reconstruction.
2. Use weeks, months and years as intervals of time.	2. Place major events in the development of their local community and the state of Michigan in chronological order.		2. Describe major factors that characterize the following eras in United States history: The Development of the Industrial United States (1870-1900), The Emergence of Modern America (1890-1930), The Great Depression and World War II (1929-1945), Post War United States (1945-1970) and Contemporary United States (1968-present).
3. Distinguish among the past, the present and the future.	3. Place major events in the early history of the United States in chronological order.	2. Describe major factors that characterize the following eras in United States history: The Meeting of Three Worlds (beginnings to 1620), Colonization and Settlement (1585-1763), Revolution and the New Nation (1754-1815), Expansion and Reform (1801-1861) and Civil War and Reconstruction (1850-1877).	
4. Place events of their lives and the lives of others in chronological order.		3. Select a contemporary condition in Africa, Asia, Canada, Europe and Latin America and trace some of the major historical origins of each.	3. Identify some of the major eras in world history and describe their defining characteristics.

Content Standard 2: All students will understand narratives about major eras of American and world history by identifying the people involved, describing the setting, and sequencing the events. (Comprehending the Past)

Early Elementary	Later Elementary	Middle School	High School
1. Identify who was involved, what happened and where it happened in stories about the past.	1. Summarize the sequence of key events in stories describing life from the past in their local community, the state of Michigan and other parts of the United States.	1. Use narratives and graphic data to describe the settings of significant events that shaped the development of Michigan as a state and the United States as a nation during the eras prior to Reconstruction.	1. Draw upon narratives and graphic data to explain significant events that shaped the development of Michigan as a state and the United States as a nation during the eras since Reconstruction.
2. Describe the past through the eyes and experiences of those who were there as revealed through their records.	2. Use narratives and graphic data to compare the past of their local community, the state of Michigan and other parts of the United States with present day life in those places.	2. Identify and explain how individuals in history demonstrated good character and personal virtue.	2. Identify and explain how individuals in history demonstrated good character and personal virtue.
3. Recount events from simple biographies of women and men representing a variety of societies from the past.	3. Recount the lives and characters of a variety of individuals from the past representing their local community, the state of Michigan and other parts of the United States.	3. Select conditions in various parts of the world and describe how they have been shaped by events from the past.	3. Select events and individuals from the past that have had global impact on the modern world and describe their impact.
4. Identify and explain how individuals in history demonstrated good character and personal virtue.	4. Identify and explain how individuals in history demonstrated good character and personal virtue.	4. Use historical biographies to explain how events from the past affected the lives of individuals and how some individuals influenced the course of history.	

Content Standard 3: All students will reconstruct the past by comparing interpretations written by others from a variety of perspectives and creating narratives from evidence. (Analyzing and Interpretin the Past)

Early Elementary	Later Elementary	Middle School	High School
1. Use a variety of records to construct a narrative about their personal or family histories.	1. Use primary sources to reconstruct past events in their local community.	1. Use primary and secondary records to analyze significant events that shaped the development of Michigan as a state and the United States as a nation prior to the end of the era of Reconstruction.	1. Use primary and secondary records to analyze significant events that shaped the development of Michigan as a state and the United States as a nation since the era of Reconstruction.
2. Differentiate between historical facts and historical interpretations.	2. Interpret conflicting accounts of events in both Michigan and United States history and analyze the viewpoints of the authors.	2. Analyze interpretations of major events selected from African, Asian, Canadian, European and Latin American history to reveal the perspectives of the authors.	2. Challenge arguments of historical inevitability by formulating examples of how different choices could have led to different consequences.
3. Explain why accounts of the same event differ.	3. Compose simple narratives of events from the history of the state of Michigan and the United States.		

| | | 3. Show that historical knowledge is tentative and subject to change by describing interpretations of the past that have been revised when new information was uncovered. | 3. Select contemporary problems in the world and compose historical narratives that explain their antecedents. |
| | | 4. Compose narratives of events from the history of Michigan and of the United States prior to the era of Reconstruction. | |

Content Standard 4: All students will evaluate key decisions made at critical turning points in history by assessing their implications and long-term consequences. (Judging Decisions from the Past)

Early Elementary	Later Elementary	Middle School	High School
1. Recall situations in their lives that required decisions and evaluate the decisions made in light of their consequences. 2. Evaluate decisions made by others as reported in stories about the past.	1. Identify problems from the past that divided their local community, the state of Michigan, and the United States and analyze the Interests and values of those involved. 2. Select decisions made to solve past problems and evaluate those decisions in terms of ethical considerations, the interests of those affected by the decisions, and the short- and long-term consequences in those decisions.	1. Identify major decisions in Michigan and the United States history prior to the end of the era of Reconstruction, analyze contemporary factors contributing to the decisions and consider alternative courses of action. 2. Identify major decisions in the history of Africa, Asia, Canada, Europe and Latin America, analyze contemporary factors contributing to the decisions and consider alternative courses of action. 3. Identify the responses of individuals to historic violations of human dignity involving discrimination, persecution and crimes against humanity. 4. Select historic decisions and evaluate them in light of core democratic values and resulting costs and benefits as viewed from a variety of perspectives.	1. Identify major decisions in the history of Michigan and the United States since the era of Reconstruction, analyze contemporary factors contributing to the decisions and consider alternative courses of action. 2. Evaluate the responses of individuals to historic violations of human dignity involving discrimination, persecution and crimes against humanity. 3. Analyze key decisions by drawing appropriate historical analogies. 4. Select pivotal decisions in United States history and evaluate them in light of core democratic values and resulting costs and benefits as viewed from a variety of perspectives.

II. Geographic Perspective

Content Standard 1: All students will describe, compare, and explain the locations and characteristics of places, cultures, and settlements. (People, Places and Cultures)

Early Elementary	Later Elementary	Middle School	High School
1. Describe the human characteristics of places and explain some basic causes for those characteristics.	1. Locate and describe cultures and compare the similarities and differences among the roles of women, men, and families.	1. Locate and describe the diverse places, cultures, and communities of major world regions.	1. Describe how major world issues and events affect various people, societies, places, and cultures in different ways.
2. Describe the natural characteristics of places and explain some basic causes for those characteristics.	2. Locate and describe diverse kinds of communities and explain the reasons for their characteristics and locations.	2. Describe and compare characteristics of major world cultures including language, religion, belief systems, gender roles, and traditions.	2. Explain how culture might affect women's and men's perceptions.
	3. Locate and describe the major places, cultures, and communities of the nation and compare their characteristics.	3. Explain why people live and work as they do in different regions.	

Content Standard 2: All students will describe, compare, and explain the locations and characteristics of ecosystems, resources, human adaptation, environmental impact, and the interrelationships among them. (Human/Environment Interaction)

Early Elementary	Later Elementary	Middle School	High School
1. Describe how people use the environment to meet human needs and wants.	1. Explain basic ecosystem concepts and processes.	1. Locate, describe, and compare the ecosystems, resources, and human environment interactions of major world regions.	1. Describe the environmental consequences of major world processes and events.
2. Describe the ways in which their environment has been changed by people, and the ways their lives are affected by the environment.	2. Describe the location, use, and importance of different kinds of resources and explain how they are created and the consequences of their use.	2. Locate major ecosystems, describe their characteristics, and explain the process that created them.	2. Assess the relationship between property ownership and the management of natural resources.
3. Suggest ways the people can help improve their environment.	3. Describe the major physical patterns, ecosystems, resources, and land uses of the state, region, and country and explain the processes that created them.	3. Explain the importance of different kinds of ecosystems to people.	
	4. Explain how various people and cultures have adapted to and modified the environment.	4. Explain how humans modify the environment and describe some of the possible consequences of those modifications.	
		5. Describe the consequences of human/environment interactions in several different types of environment.	

Content Standard 3: All students will describe, compare, and explain the locations and characteristics of economic activities, trade, political activities, migration, information flow, and the interrelationships among them. (Location, Movement and Connections)

Early Elementary	Later Elementary	Middle School	High School
1. Identify locations of significance in their immediate environment and explain reasons for their location. 2. Identify people and places in other locations and explain their importance to the community. 3. Identify people, goods, services and ideas in their local community which have come from other places and describe why they moved.	1. Describe major kinds of economic activity and explain the factors influencing their location. 2. Describe the causes, consequences, routes and movement of major migration to the United States. 3. Explain how transportation and communication link people and communities. 4. Describe some of the major movements of goods, people, jobs and information within Michigan and the United States and explain the reasons for the movements.	1. Locate and describe major economic activities and occupations of major world regions and explain the reasons for their locations. 2. Explain how governments have divided land and sea areas into different regions. 3. Describe how and why people, goods and services, and information move within world regions and between regions. 4. Describe the major economic and political connections between the United States and different world regions and explain their causes and consequences.	1. Describe major world patterns of economic activity and explain the reasons for the patterns. 2. Explain how events have causes and consequences in different parts of the world.

Content Standard 4: All students will describe and compare characteristics of ecosystems, states, regions, countries, major world regions, and patterns and explain the processes that created them. (Regions, Patterns and Processes)

Early Elementary	Later Elementary	Middle School	High School
1. Identify regions in their immediate environment and describe their characteristics and boundaries. 2. Compare their community and region with others. 3. Describe changes in the region over time as well as presently.	1. Draw sketch maps of the community, region, and nation. 2. Describe places, cultures, and communities in the United States and compare them with those in other regions and countries. 3. Describe the geography of Michigan at major times in its history and explain the reasons for its change.	1. Draw a sketch map of the world from memory. 2. Locate and describe major cultural, economic, political and environmental features of Africa, Europe, Asia, Australia and North and South America and the processes that created them. 3. Describe major patterns of world population, physical features, ecosystems, cultures and explain some of the factors causing the patterns.	1. Explain how major world processes affect different world regions. 2. Explain how major world regions are changing. 3. Explain how processes like population growth, economic development, urbanization resource use, international trade, global communication, and environmental impact are affecting different world regions.

4. Describe the physical, economic, and cultural geography of contemporary Michigan and its causes, advantages, and disadvantages.

5. Describe the Great Lakes ecosystem, and explain physical and human pro-cesses that act upon them.

6. Describe the geography of major United States regions, compare the regions, and explain the processes that created them.

4. Compare major world regions with respect to cultures, economy, governmental systems, environment, and communications.

4. Describe major patterns of economic development and political systems and explain some of the factors causing them.

Content Standard 5: All students will describe and explain the causes, consequences, and geographic context of major global issues and events. (Global Issues and Events)

Early Elementary	Later Elementary	Middle School	High School
1. Locate and describe major world events that are having an impact on their community and explain why they are important to the community.	1. Locate major world events and explain how they impact people and the environment.	1. Describe how social and scientific changes in regions may have global consequences. 2. Describe the geographic aspects of events taking place in different world regions. 3. Explain how elements of the physical geography, culture, and history of the region may be influencing current events.	1. Explain how geography and major world processes influence major world events. 2. Explain the causes and importance of global issues involving cultural stability and change, economic development and international trade, resource use, environmental impact, conflict and cooperation, and explain how they may affect the future.

III. Civic Perspective

Content Standard 1: All students will identify the purposes of national, state, and local governments in the United States, describe how citizens organize government to accomplish their purposes, and assess their effectiveness. (Purposes of Government)

Early Elementary	Later Elementary	Middle School	High School
1. Cite examples of government carrying out its legal authority in their local community. 2. Describe consequences of not having rules.	1. Distinguish among local, state, and national government in the United States and describe the roles of government institutions at all three levels. 2. Give examples of authority and the use of power without authority. 3. Give reasons for limiting the power of government.	1. Describe how the federal government in the United States serves the purposes set forth in the Preamble to the Constitution. 2. Distinguish between representative democracy in the United States and other forms of government. 3. Explain how the rule of law protects individual rights and serves the common good. 4. Explain the importance of limited government to protect political and economic freedom.	1. Explain the advantages and disadvantages of a federal system of government. 2. Evaluate how effectively the federal government is serving the purposes for which it was created. 3. Evaluate the relative merits of the American presidential system and parliamentary systems.

Content Standard 2: All students will explain the meaning and origin of the ideas, including the core democratic values expressed in the Declaration of Independence, the Constitution, and other foundational documents of the United States. (Ideals of American Democracy)

Early Elementary	Later Elementary	Middle School	High School
1. Identify aspects of life at school and in the local community that illustrate justice and freedom.	1. Interpret the development and summarize the main points in the Declaration of Independence. 2. Interpret the meaning of specific rights guaranteed by the Constitution including religious liberty, free expression, privacy, property, due process of law and equal protection of the law. 3. Explain responsibilities citizens have to uphold constitutional rights.	1. Identify the essential ideas expressed in the Declaration of Independence and the origins of those ideas, and explain how they set the foundation for civic life, politics and government in the United States. 2. Describe provisions of the U.S. Constitution which delegate to government the powers necessary to fulfill the purposes for which it was established. 3. Explain means for limiting the powers of government established by the U.S. Constitution.	1. Identify benefits and challenges of diversity in American life. 2. Use the ideas in the Declaration of Independence to evaluate the conduct of citizens, political behavior, and the practices of government.

Content Standard 3: All students will describe the political and legal processes created to make decisions, seek consensus and resolve conflicts in a free society. (Democracy in Action)

Early Elementary	Later Elementary	Middle School	High School
1. Explain how conflicts at school or in the local community might be resolved in ways that are consistent with core democratic values.	1. Describe what state and federal courts are expected to do. 2. Describe issues that arise over constitutional rights.	1. Distinguish between civil and criminal procedure. 2. Identify disparities between American ideals and realities and propose ways to reduce them.	1. Using actual cases, evaluate the effectiveness of civil and criminal courts in the United States. 2. Explain why people may agree on democratic values in the abstract but disagree when they are applied to specific situations. 3. Evaluate possible amendments to the Constitution.

Content Standard 4: All students will explain how American governmental institutions, at the local, state, and federal levels, provide for the limitation and sharing of power and how the nation's political system provides for the exercise of power. (American Government and Politics)

Early Elementary	Later Elementary	Middle School	High School
1. Identify rules at school and in the local community and consider consequences for breaking rules. 2. Describe fair ways for groups to make decisions. 3. Describe ways that individuals influence each other.	1. Distinguish among making, enforcing, and interpreting laws. 2. Explain how law is used to manage conflict in American society. 3. Explain the basic organization of the local, state, and federal governments. 4. Describe how citizens participate in election campaigns.	1. Evaluate information and arguments from various sources in order to evaluate candidates for public office. 2. Explain how the Constitution is maintained as the supreme law of the land.	1. Evaluate proposals for reform of the political system. 2. Analyze causes of tension between the branches of government.

Content Standard 5: All students will understand how the world is organized politically, the formation of American foreign policy and the roles the United States plays in the international arena. (American Government and World Affairs)

Early Elementary	Later Elementary	Middle School	High School
1. Distinguish between events in this country and events abroad. 2. Recognize that events in other countries can affect Americans.	1. Explain various ways that nations of the world interact with each other. 2. Describe events in other countries that have affected Americans and, conversely, events within	1. Describe the purposes and functions of major international, governmental organizations. 2. Describe means used by the United States to resolve international conflicts.	1. Describe the influence of the American concept of democracy and individual rights in the world. 2. Evaluate foreign policy positions in light of national interests and American values.

| | the United States that have affected other countries. | | | 3. Decide what the relationship should be between the United States and international organizations. |

IV. Economic Perspective

Content Standard 1: All students will describe and demonstrate how the economic forces of scarcity and choice affect the management of personal financial resources, shape consumer decisions regarding the purchase, use, and disposal of goods and services and affect the economic well-being of individuals and society. (Individual and Household Choices)

Early Elementary	Later Elementary	Middle School	High School
1. Identify ways families produce and consume goods and services. 2. List ways that individuals can conserve limited resources.	1. Explain why people must face scarcity when making economic decisions. 2. Identify the opportunity costs in personal decision making situations. 3. Use a decision making model to explain a personal choice. 4. Analyze the costs, benefits, and alternatives to using consumer credit.	1. Use economic reasoning when comparing price, quality and features of goods and services. 2. Evaluate employment and career opportunities in light of economic trends. 3. Analyze the reliability of information when making economic decisions.	1. Design a strategy for earning, spending, saving, and investing their resources. 2. Evaluate the impact on households of alternative solutions to societal problems such as health care, housing, or energy use. 3. Analyze ways individuals can select suppliers of goods and services and protect themselves from deception in the marketplace.

Content Standard 2: All students will explain and demonstrate how businesses confront scarcity and choice when organizing, producing, and using resources, and when supplying the marketplace. (Business Choices)

Early Elementary	Later Elementary	Middle School	High School
1. Connect economic needs with businesses that meet them. 2. Select a particular good or service and describe the types of resources necessary to produce and distribute it.	1. Distinguish between natural resources, human capital, and capital equipment in the production of a good or service. 2. Distinguish among individual ownership, partnership, and corporation.	1. Using a real example, describe how business practices, profit, and a willingness to take risks, enabled an entrepreneur to operate. 2. Compare various methods for the production and distribution of goods and services. 3. Describe the effects of a current public policy on businesses.	1. Outline the decision making process a business goes through when deciding whether to export to a foreign market. 2. Evaluate ways to resolve conflicts resulting from differences between business interests and community values.

3. Examine the historical and contemporary role a major industry has played in the state of Michigan and the United States.	4. Examine the historical and contemporary role an industry has played and continues to play in a community.

Content Standard 3: All students will describe how government decisions on taxation, spending, public goods, and regulation impact what is produced, how it is produced, and who receives the benefits of production. (Role of Government)

Early Elementary	Later Elementary	Middle School	High School
1. Describe a good or service provided by the local government and the method of payment.	1. Use a decision making model to explain a choice involving a public good or service.	1. Distinguish between public and private goods using contemporary examples.	1. Describe the use of economic indicators and assess their accuracy.
2. Identify the goods and services their school provides and the people who provide them.	2. Distinguish between the economic roles of local, state, and federal governments and cite examples of each.	2. Identify and describe different forms of economic measurement.	2. Distinguish between monetary and fiscal policy and explain how each might be applied to problems such as unemployment and inflation.
3. Identify an unmet local economic need and propose a plan to meet it.	3. Use a local example to assess the effectiveness of the government at providing public goods or resolving an economic dispute.	3. Use case studies to assess the role of government in the economy.	3. Compare governmental approaches to economic growth in developing countries.
		4. Distinguish different forms of taxation and describe their effects.	4. Evaluate a government spending program on the basis of its intended and unintended results.
			5. Select criteria to use in evaluating tax policy.

Content Standard 4: All students will explain how a free market economic system works, as well as other economic systems, to coordinate and facilitate the exchange, production, distribution, and consumption of goods and services. (Economic Systems)

Early Elementary	Later Elementary	Middle School	High School
1. Identify examples of markets they experience in their daily life.	1. Explain how prices are determined in a market economy and how they serve as a means of allocating resources.	1. Compare the historical record of market economies in solving the problem of scarcity.	1. Use case studies to exemplify how supply and demand, prices, incentives, and profits determine what is produced and distributed in a competitive world market.
2. Distinguish between producers and consumers in a market economy.			

Early Elementary	Later Elementary	Middle School	High School
3. Describe how the choices they make impact business decisions.	2. Describe how they act as a producer and a consumer. 3. Analyze how Michigan's location has impacted its economic development.	2. Describe the roles of the various economic institutions which comprise the American economic system such as governments, business firms, labor unions, banks, and households. 3. Use case studies to exemplify how supply and demand, prices, incentives, and profits determine what is produced and distributed in the American economy. 4. Analyze how purchasers obtain information about goods and services from advertising and other sources.	2. Describe relationships between a domestic economy and the international economic system. 3. Evaluate the United States and other economic systems on their ability to achieve broad social goals such as freedom, efficiency, equity, security, development, and stability. 4. Describe relationships among the various economic institutions that comprise economic systems such as households, business firms, banks, government agencies, and labor unions. 5. Compare and contrast a free market economic system with other economic systems.

Content Standard 5: All students will describe how trade generates economic development and interdependence and analyze the resulting challenges and benefits for individuals, producers, and government. (Trade)

Early Elementary	Later Elementary	Middle School	High School
1. Recognize economic exchanges in which they participate. 2. Identify United States coin and currency denominations and describe the role of cash in the exchange of goods and services.	1. Trace the national origin of common household items and the trade flows which brought them to the United States. 2. Describe benefits of international trade to consumers and producers. 3. Describe how businesses are involved in trade as producers, distributors, importers, and exporters.	1. Identify the current and potential contributions of national and world regions to trade. 2. Examine the role of the United States government in regulating commerce as stated in the United States Constitution. 3. Describe the historical development of the different means of payment such as barter, precious metals, or currency to facilitate exchange.	1. Evaluate the benefits and problems of an economic system built on voluntary exchange. 2. Trace the historical development of international trading ties. 3. Explain how specialization, interdependence and economic development are related. 4. Describe the effect of currency exchange, tariffs, quotas, and product standards on world trade and domestic economic activity.

V. Inquiry

Content Standard 1: All students will acquire information from books, maps, newspapers, data sets and other sources, organize and present the information in maps, graphs, charts and timelines, interpret the meaning and significance of information, and use a variety of electronic technologies to assist in accessing and managing information. (Information Processing)

Early Elementary	Later Elementary	Middle School	High School
1. Locate information using people, books, audio/video recordings, photos, simple maps, graphs and tables.	1. Locate information about local, state and national communities using a variety of traditional sources, electronic technologies, and direct observations.	1. Locate and interpret information about the natural environments and cultures of countries using a variety of primary and secondary sources and electronic technologies, including computers and telecommunications where appropriate.	1. Locate information pertaining to a specific social science topic in-depth using a variety of sources and electronic technologies.
2. Acquire information from observation of the local environment.	2. Organize social science information to make maps, graphs and tables.	2. Use traditional and electronic means to organize social science information and to make maps, graphs, and tables.	2. Use traditional and electronic means to organize and interpret information pertaining to a specific social science topic and prepare it for in-depth presentation.
3. Organize information to make and interpret simple maps of their local surroundings and simple graphs and tables of social data drawn from their experience.	3. Interpret social science information about local, state, and national communities from maps, graphs, and charts.	3. Interpret social science information about the natural environment and cultures of countries from a variety of primary and secondary sources.	3. Develop generalizations pertaining to a specific social science topic by interpreting information from a variety of sources.

Content Standard 2: All students will conduct investigations by formulating a clear statement of a question, gathering and organizing information from a variety of sources, analyzing and interpreting information, formulating and testing hypotheses, reporting results both orally and in writing, and making use of appropriate technology. (Conducting Investigations)

Early Elementary	Later Elementary	Middle School	High School
1. Pose a question about life in their school or local community.	1. Pose a social science question about Michigan or the United States.	1. Pose a social science question about a culture, world region, or international problem.	1. Conduct an investigation prompted by a social science question and compare alternative interpretations of their findings.
2. Gather and analyze information in order to answer the question posed.	2. Gather and analyze information using appropriate information technologies to answer the question posed.	2. Gather and analyze information using appropriate information technologies to answer the question posed.	2. Report the results of their investigation including procedures followed and a rationale for their conclusions.
3. Construct an answer to the question posed and support their answer with evidence.	3. Construct an answer to the question posed and support their answer with evidence.	3. Construct an answer to the question posed and support their answer with evidence.	
4. Report the results of their investigation.			

4. Report the result of their investigation including the procedures followed.	4. Report the results of their investigation including procedures followed and possible alternative conclusions.		

VI. Public Discourse and Decision Making

Content Standard 1: All students will state an issue clearly as a question of public policy, trace the origins of the issue, analyze various perspectives people bring to the issue and evaluate possible ways to resolve the issue. (Identifying and Analyzing Issues)

Early Elementary	Later Elementary	Middle School	High School
1. Pose a question about matters of public concern that they have encountered in school or in the local community. 2. Compare their own viewpoint about the matter raised with that of another individual.	1. Pose local, state, and national policy issues as questions. 2. Explain how a particular public issue became a problem and why people disagree about it. 3. Evaluate possible resolutions of a public issue.	1. State public policy issues and their related ethical, definitional, and factual issues as questions. 2. Trace the origins of a public issue. 3. Explain how culture and experiences shape positions that people take on an issue.	1. Generate possible alternative resolutions to public issues and evaluate them using criteria that have been identified.

Content Standard 2: All students will engage their peers in constructive conversation about matters of public concern by clarifying issues, considering opposing views, applying democratic values, anticipating consequences, and working toward making decisions. (Group Discussion)

Early Elementary	Later Elementary	Middle School	High School
1. Engage each other in conversations about issues pertaining to governing their school.	1. Engage each other in conversations which attempt to clarify and resolve issues pertaining to local, state, and national policy.	1. Engage each other in conversations which attempt to clarify and resolve national and international policy issues.	1. Engage each other in elaborated conversations that deeply examine public policy issues and help make reasoned and informed decisions.

Content Standard 3: All students will compose coherent written essays that express a position on a public issue and justify the position with reasoned arguments. (Persuasive Writing)

Early Elementary	Later Elementary	Middle School	High School
1. Compose brief statements expressing a decision on an issue in the school or local community.	1. Compose a short essay expressing a decision on a local, state, or national policy issue.	1. Compose essays expressing decisions on national and international policy issues.	1. Compose extensively elaborated essays expressing and justifying decisions on public policy issues.

VII. Citizen Involvement

Content Standard 1: All students will consider the effects of an individual's actions on other people, how one acts in accordance with the rule of law, and how one acts in a virtuous and ethically responsible way as a member of society. (Responsible Personal Conduct)

Early Elementary	Later Elementary	Middle School	High School
1. Help to determine, interpret and enforce school rules.	1. Report how their behavior has been guided by concern for the law.	1. Use laws and other ethical rules to evaluate their own conduct and the conduct of others.	1. Act out of respect for the rule of law and hold others accountable to the same standard.
2. Participate in projects designed to help others in their local community.	2. Engage in activities intended to contribute to solving a local, state or national problem they have studied.	2. Engage in activities intended to contribute to solving a national or international problem they have studied.	2. Plan and conduct activities intended to advance their views on matters of public policy, report the results of their efforts and evaluate their effectiveness.

Mathematics

Mathematics is the science of patterns and relationships. It is the language and logic of our technological world. Mathematical power is the ability to explore, to conjecture, to reason logically and to use a variety of mathematical methods effectively to solve problems. The ultimate goal of mathematics education is for all students to develop mathematical power to participate fully as a citizen and worker in our contemporary world.

A mathematically powerful individual should be able to:

- reason mathematically;
- communicate mathematically;
- problem solve using mathematics; and,
- make connections within mathematics and between mathematics and other fields.

The fifteen content standards have been categorized into the following six strands:

I. **Patterns, Relationships, and Functions**

II. **Geometry and Measurement**

III. **Data Analysis and Statistics**

IV. **Number Sense and Numeration**

V. **Numerical and Algebraic Operations and Analytical Thinking**

VI. **Probability and Discrete Mathematics**

OVERVIEW OF THE MATHEMATICS CONTENT STRANDS

Strand I. Patterns, Relationships, and Functions
Patterns, relationships and functions comprise one of the most important themes in the study of mathematics. Mathematical thinking begins with the recognition of similarities among objects or events, proceeds to generalization and abstraction, and culminates in the ability to understand, explain and make predictions. Contexts that exhibit structure and regularity provide rich opportunities for describing the physical world, studying mathematics and solving problems.

Standard I.1 Patterns
Students recognize similarities and generalize patterns, use patterns to create models and make predictions, describe the nature of patterns and relationships, and construct representations of mathematical relationships.

Wherever there is mathematics there are patterns, and wherever there are patterns there is mathematics. Patterns are regularities or similarities that characterize sets of numbers, shapes, graphs, tables or other mathematical objects. Mathematicians look for patterns in everything they do; thus, mathematics is frequently defined as the science of patterns. In studying mathematics, students learn to recognize, describe, analyze and create patterns, to extend and generalize patterns, to create mathematical models based on observed patterns, and to predict the behavior of real-world phenomena based on such observed patterns. They learn to communicate the nature of mathematical patterns and relationships in various ways including words, physical models, diagrams, tables, charts, graphs, and equations. Since each representation highlights different aspects of the patterns and relationships, students must be able to construct multiple representations of mathematical relationships and to translate among them.

Standard I.2 Variability and Change
Students describe the relationships among variables, predict what will happen to one variable as another variable is changed, analyze natural variation and sources of variability, and compare patterns of change.

Variability and change are as fundamental to mathematics as they are to the physical world, and an understanding of the concept of a variable is essential to mathematical thinking. Students must be able to describe the relationships among variables, to predict what will happen to one variable as another variable is changed, and to compare different patterns of change. The study of variability and change provides a basis for making sense of the world and of mathematical ideas.

Strand II. Geometry and Measurement
We live in a three-dimensional world. In order to interpret and make sense of that world, students need both analytical and spatial abilities. Geometry and measurement, which involve notions of shape, size, position, and dimension, are used extensively to describe and understand the world around us.

Standard II.1 Shape and Shape Relationships
Students develop spatial sense, use shape as an analytic and descriptive tool, identify characteristics and define shapes, identify properties and describe relationships among shapes.

Spatial sense is developed when students recognize, draw, construct, visualize, compare, classify and transform geometric shapes in both two and three dimensions. They learn to identify those characteristics that are necessary to define a given shape, and they can differentiate one shape from another. Students also develop an awareness of the properties of a shape and of the relationships among shapes. This

includes hierarchical classifications of shapes (e.g., all squares are rhombuses), relationships among components of a shape (e.g., opposite sides of a rectangle are parallel), symmetries of a shape, congruence and similarity.

Standard II.2   Position
Students identify locations of objects, identify location relative to other objects, and describe the effects of transformations (e.g., sliding, flipping, turning, enlarging, reducing) on an object.

Position refers to the location of physical objects or points in space as well as to the relative locations and positions of objects, points, lines, planes and other geometric elements. It includes such notions as betweenness, collinearity and coordinates in two and three dimensions, as well as the locus of a point as it moves through space and the location of special points.

Standard II.3   Measurement
Students compare attributes of two objects or of one object with a standard (unit), and analyze situations to determine what measurement(s) should be made and to what level of precision.

Measurement reflects the usefulness and practicality of mathematics and puts students in touch with the world around them. Measurement requires the comparison of an attribute (distance, surface, capacity, mass, time, temperature) between two objects or to a known standard, the assignment of a number to represent the comparison, and the interpretation of the results. Measurement also introduces students to the important concepts of precision, approximation, tolerance, error and dimension.

Strand III. Data Analysis and Statistics
We live in a sea of information. In order not to drown in the data that inundate our lives every day, we must be able to process and transform data into useful knowledge. The ability to interpret data and to make predictions and decisions based on data is an essential basic skill for every individual.

Standard III.1 Collection, Organization and Presentation of Data
Students collect and explore data, organize data into a useful form, and develop skill in representing and reading data displayed in different formats.

Knowing what data to collect and where and how to collect them is the starting point of quantitative literacy. The mathematics curriculum should capitalize on students' natural curiosity about themselves and their surroundings to motivate them to collect and explore interesting statistics and measurements derived from both real and simulated situations. Once the data are gathered, they must be organized into a useful form, including tables, graphs, charts and pictorial representations. Since different representations highlight different patterns within the data, students should develop skill in representing and reading data displayed in different

formats, and they should discern when one particular representation is more desirable than another.

Standard III.2 Description and Interpretation
Students examine data and describe characteristics of a distribution, relate data to the situation from which they arose, and use data to answer questions convincingly and persuasively.

Students must be able to examine data and describe salient characteristics of the distribution. They also must be able to relate the data to the physical situation from which they arose. Students should use the data to answer key questions and to convince and persuade.

Standard III.3 Inference and Prediction
Students draw defensible inferences about unknown outcomes, make predictions, and identify the degree of confidence they have in their predictions.

Based on known data, students should be able to draw defensible inferences about unknown outcomes. They should be able to make predictions and to identify the degree of confidence that they place in their predictions.

Strand IV. Number Sense and Numeration
Number sense is to mathematics what vocabulary is to language. Students must learn to quantify and measure, concretely at first and increasingly more abstractly as they mature. They also must develop an understanding of numeration systems and of the structure of such systems. They must learn to estimate mathematical quantities and to represent and communicate mathematical ideas in the language of mathematics.

Standard IV.1 Concepts and Properties of Numbers
Students experience counting and measuring activities to develop intuitive sense about numbers, develop understanding about properties of numbers, understand the need for and existence of different sets of numbers, and investigate properties of special numbers.

Fundamental questions like "What is a number?" or "What is three?" can be deceptively difficult to answer. Students require extensive involvement with concrete experiences of counting and measuring in order to develop an intuitive sense about number. Through both informal and formal means, students develop understanding about important properties of numbers such as even vs. odd, whole number vs. fraction, positive vs. negative. They understand the existence of different sets of numbers (whole numbers, integers, rationals, reals, ...) and the properties of special numbers such as 0, 1, π, or the inverse of a number.

Standard IV.2 Representation and Uses of Numbers
Students recognize that numbers are used in different ways such as counting, measuring, ordering and estimating, understand and produce multiple representations of a number, and translate among equivalent representations.

Students recognize that numbers are used in different ways such as to answer the questions "How many?" (counting), "How much?" (measuring), and "Which one?" (ordering). They understand that a numerical quantity can be represented in many different ways, and they can produce multiple representations of numbers (e.g., fractions, decimals, and percents in the middle grades; vectors and coordinate representations in later years) and they can translate easily among equivalent representations. As students mature from the middle school on, they develop a solid understanding of both linearity and proportionality.

Standard IV.3 Number Relationships

Students investigate relationships such as equality, inequality, inverses, factors and multiples, and represent and compare very large and very small numbers.

Students develop understanding of important relationships among numbers including the relationships of ($=$, $\neq$) and ($<$, $>$); of opposites (additive inverses) and reciprocals (multiplicative inverses); of factors and multiples; of primes, composites, and relatively prime numbers; of powers and roots. They understand and can represent very large and very small numbers and can compare the orders of magnitude of numbers.

Strand V. Numerical and Algebraic Operations and Analytical Thinking

The ability to represent quantitative situations with algebraic symbolism, numerical operations and algebraic thinking is essential to solving problems in significant contexts and applications. The concepts of number and variable and their symbolic representation and manipulation are central to the understanding of arithmetic and its generalization in algebra. The contemporary applications of mathematics in virtually every field of work and study rely on algebraic and analytic thinking and communication as fundamental tools.

Standard V.1 Operations and Their Properties

Students understand and use various types of operations (e.g., addition, subtraction, multiplication, division) to solve problems.

The ultimate reason for mastering the operations of arithmetic and algebra is to solve problems. To that end, understanding the basic computational operations and their algorithms is essential for competence in mathematics, but the emphasis must be on understanding and using the operations, not on memorizing algorithms. In computation, understanding and accuracy are always more important than speed. Understanding the operations requires the concomitant understanding and application of the properties of those operations, and it involves knowing what operations to use in a particular situation. There is no one way to perform a calculation. Students must be competent in performing calculations, but they need not have a rigid adherence to one algorithm. Methods of computation include proficiency with mental calculation, paper and pencil, and calculators; the

ability to represent computations with manipulatives and geometric models; and the discernment of which computational method to use in a given situation. Computational methods also involve estimating and assessing the reasonableness of the results of a computation.

Standard V.2 Algebraic and Analytic Thinking

Students analyze problems to determine an appropriate process for solution, and use algebraic notations to model or represent problems.

Mathematical representations allow us to visualize and understand problems. These representations may be numerical, literal, symbolic, graphical, pictorial or physical. Facility with multiple representations of numerical and algebraic concepts and relationships is essential to mathematical competence. This includes the development of "symbol sense" as well as "number sense" and the understanding that the notion of solution involves a process as well as a product. Thus, the solution of a mathematical problem requires both an understanding of the question for which an answer is sought and the development of a strategy to obtain that answer. The context of the problem determines the nature and the degree of precision of the required solution. The increasing use of quantitative methods in all disciplines has made algebra the fundamental tool for mathematical applications. Algebraic thinking is learned most effectively when it is studied in the context of applications, both mathematical and real-world, that reveal the power of algebra to model real problems and to generalize to new situations. Students should use algebraic techniques to analyze and describe relationships, to model problem situations, and to examine the structure of mathematical relationships. The algebra curriculum should employ contemporary technology, including spreadsheets and graphical analysis, to emphasize conceptual understanding of algebra and analytic thinking as sophisticated means of representation and as powerful problem-solving tools.

Strand VI. Probability and Discrete Mathematics

Contemporary uses of mathematics demand that students learn to deal with uncertainty, to make informed decisions based on evidence and expectations, to exercise critical judgment about conclusions drawn from data, and to apply mathematical models to real-world phenomena. The technological world in which we live also depends upon information and the communication of information and upon applications of systems with separate (discrete) entities. Topics of discrete mathematics such as counting and permutation problems, matrix operations, vertex-edge networks, and relationships among finite sets have significant real-world applications that students will encounter in diverse fields of work and study.

Standard VI.1 Probability

Students develop an understanding of the notion of certainty and of probability as a measure of the degree of likelihood that

can be assigned to a given event based on the knowledge available, and make critical judgments about claims that are made in probabilistic situations.

Dealing with uncertainty and making predictions and decisions in the face of uncertainty are essential skills for coping with the modern world. Students must develop an understanding of the notion of uncertainty and of probability as a measure of the degree of likelihood that can be assigned to a given event based on the knowledge available. They also must be able to make critical judgments about claims that are made in probabilistic situations.

Standard VI.2 Discrete Mathematics
Students investigate practical situations such as scheduling, routing, sequencing, networking, organizing and classifying, and analyze ideas like recurrence relations, induction, iteration, and algorithm design.

Discrete (discontinuous) mathematics has grown in significance in recent years and today has applications in many important practical situations such as scheduling, routing, sequencing, networking, organizing and classifying. Important ideas like recurrence relations, induction and algorithm design also have practical applications in a variety of fields. Computers, which are finite, discrete machines, require an understanding of discrete mathematics for the solution of problems using computer methods.

MATHEMATICS

CONTENT STANDARDS AND WORKING DRAFT BENCHMARKS

I. Patterns, Relationships and Functions

Content Standard 1: Students recognize similarities and generalize patterns, use patterns to create models and make predictions, describe the nature of patterns and relationships, and construct representations of mathematical relationships. (Patterns)

Elementary	Middle School	High School
1. Recognize, describe and extend numerical and geometric patterns.	1. Describe, analyze and generalize patterns arising in a variety of contexts and express them in general terms.	1. Analyze and generalize mathematical patterns including sequences, series and recursive patterns.
2. Represent and record patterns and relationships in a variety of ways including tables, charts and pictures.	2. Represent and record patterns in a variety of ways including tables, charts and graphs, and translate between various representations.	2. Analyze, interpret and translate among representations of patterns including tables, charts, graphs, matrices and vectors.
3. Use patterns to describe real-world phenomena.	3. Use patterns and their generalizations to make and justify inferences and predictions.	3. Study and employ mathematical models of patterns to make inferences, predictions and decisions.
4. Explore various types of numeric and geometric patterns (repeating, growing, shrinking).	4. Explore and describe visual and numeric patterns, including linear expressions, near-linear patterns and symmetric and spatial patterns.	4. Explore patterns (graphic, numeric, etc.) characteristic of families of functions; explore structural patterns within systems of objects, operations or relations.
5. Apply their experiences with patterns to help solve problems and explore new content.	5. Use patterns and generalizations to solve problems and explore new content.	5. Use patterns and reasoning to solve problems and explore new content.

Content Standard 2: Students describe the relationships among variables, predict what will happen to one variable as another variable is changed, analyze natural variation and sources of variability, and compare patterns of change. (Variability and Change)

Elementary	Middle School	High School
1. Recognize change and variability when it occurs in a variety of settings.	1. Identify and describe the nature of change; recognize change in more abstract and complex situations and explore different kinds of change and patterns of variation.	1. Identify and describe the nature of change and begin to use the more formal language such as rate of change, continuity, limit, distribution and deviation.
2. Recognize that change is often predictable, but variable, and that patterns emerge that help to describe the change.	2. Connect an initial state to a final state and generalize a rule that describes a pattern of change.	2. Develop a mathematical concept of function and recognize that functions display characteristic patterns of change (e.g., linear, quadratic, exponential).

3. Explore change, and realize that changes are frequently interdependent.	3. Begin to investigate applications in bivariate data and linear relationships and explore questions of what will happen to one quantity if another variable is changed.	3. Expand their understanding of function to include non-linear functions, composition of functions, inverses of functions, and piecewise- and recursively-defined functions.
4. Use tables, charts, open sentences and hands-on models to represent change and variability.	4. Represent variability or change by ordered pairs, tables, graphs and equations.	4. Represent functions using symbolism such as matrices, vectors and functional representation (f(x)).
5. Begin to describe and differentiate between types of relationships, especially repeating, growing and shrinking patterns.	5. Differentiate between functions and relationships such as linear vs. not linear or continuous vs. non-continuous.	5. Differentiate and analyze classes of functions including linear, power, quadratic, exponential, circular and trigonometric functions, and realize that many different situations can be modeled by a particular type of function.
6. Explore variability and change in a variety of contexts, investigations and problems.	6. Continue to explore relationships arising from interesting contexts and use variables and relationships to solve mathematical problems.	6. Increase their use of functions and mathematical models to solve problems in context.

II. Geometry and Measurement

Content Standard 1: Students develop spatial sense, use shape as an analytic and descriptive tool, identify characteristics and define shapes, identify properties and describe relationships among shapes. (Shape and Shape Relationships)

Elementary	Middle School	High School
1. Recognize and name familiar shapes in one, two and three dimensions such as lines, rectangles and spheres and informally discuss the shape of a graph.	1. Distinguish among shapes and differentiate between examples and non-examples of shapes based on their properties; generalize about shapes of graphs and data distributions.	1. Use shape to identify plane and solid figures, graphs, loci, functions and data distributions.
2. Describe the attributes of familiar shapes.	2. Generalize the characteristics of shapes and apply their generalizations to classes of shapes.	2. Determine necessary and sufficient conditions for the existence of a particular shape and apply those conditions to analyze shapes.
3. Compare, sort and classify familiar shapes.	3. Derive generalizations about shapes and apply those generalizations to develop classifications of familiar shapes.	3. Use transformational, coordinate or synthetic methods to verify (prove) the generalizations they have made about properties of classes of shapes.
4. Draw and build familiar shapes.	4. Construct familiar shapes using coordinates, appropriate tools (including technology), sketching and drawing two- and three-dimensional shapes.	4. Draw and construct shapes in two and three dimensions and analyze and justify the steps of their constructions.

5. Explore ways to combine, dissect and transform shapes.	5. Combine, dissect and transform shapes.	5. Study transformations of shapes using isometries, size transformations and coordinate mappings.
6. Recognize parallel and perpendicular line segments and figures that have similarity and/or congruence.	6. Generalize about the common properties of similar, congruent, parallel and perpendicular shapes and verify their generalizations informally.	6. Compare and analyze shapes and formally establish the relationships among them, including congruence, similarity, parallelism, perpendicularity and incidence.
7. Use shape, shape properties and shape relationships to describe the physical world and to solve problems.	7. Use shape, shape properties and shape relationships to describe the physical world and to solve problems.	7. Use shape, shape properties and shape relationships to describe the physical world and to solve problems.

Content Standard 2: Students identify locations of objects, identify location relative to other objects, and describe the effects of transformations (e.g., sliding, flipping, turning, enlarging, reducing) on an object. (Position)

Elementary	Middle School	High School
1. Locate and describe objects in terms of their position, including front, back, inside, outside, right, left, over, under, next to, between and locations on the number line, on a coordinate graph and on a map.	1. Locate and describe objects in terms of their position, including compass directions, Cartesian coordinates, latitude and longitude and midpoints.	1. Locate and describe objects in terms of their position, including polar coordinates, three-dimensional Cartesian coordinates, vectors and limits.
2. Locate and describe objects in terms of their orientation, direction and relative position, including up, down, front, back, N- S- E- W, flipped, turned, translated; recognize symmetrical objects and identify their lines of symmetry.	2. Locate and describe objects in terms of their orientation and relative position, including coincident, collinear, parallel, perpendicular; differentiate between fixed (e.g., N- S- E- W) and relative (e.g., right-left) orientations; recognize and describe examples of bilateral and rotational symmetry.	2. Locate and describe objects in terms of their orientation and relative position, including displacement (vectors), phase shift, maxima, minima and inflection points; give precise mathematical descriptions of symmetries.
3. Explore what happens to the size, shape and position of an object after sliding, flipping, turning, enlarging or reducing it.	3. Describe translations, reflections, rotations and dilations using the language of transformations and employ transformations to verify congruence of figures.	3. Give precise mathematical descriptions of transformations and describe the effects of transformations on size, shape, position and orientation.
	4. Locate the position of points or objects described by two or more conditions; locate all the points (locus) that satisfy a given condition.	4. Describe the locus of a point by a rule or mathematical expression; trace the locus of a moving point.
5. Use concepts of position, direction and orientation to describe the physical world and to solve problems.	5. Use concepts of position, direction and orientation to describe the physical world and to solve problems.	5. Use concepts of position, direction and orientation to describe the physical world and to solve problems.

Content Standard 3: Students compare attributes of two objects, or of one object with a standard (unit), and analyze situations to determine what measurement(s) should be made and to what level of precision. (Measurement)

Elementary	Middle School	High School
1. Compare attributes of objects; develop standard units of measurement; and select and use standard tools for measurement.	1. Select and use appropriate tools; measure objects using standard units in both the metric and common systems and measure angles in degrees.	1. Select and use appropriate tools; make accurate measurements using both metric and common units, and measure angles in degrees and radians.
2. Identify the attribute to be measured and select the appropriate unit of measurement for length, mass (weight), area, perimeter, capacity, time, temperature and money.	2. Identify the attribute to be measured and select the appropriate unit of measurement for length, mass (weight), time, temperature, perimeter, area, volume and angle.	2. Continue to make and apply measurements of length, mass (weight), time, temperature, area, volume, angle; classify objects according to their dimensions.
3. Develop strategies for estimating measures and compare the estimates to the results of the measurement; decide if an estimate is "a good estimate."	3. Estimate measures with a specified degree of accuracy and decide if an estimate or a measurement is "close enough."	3. Estimate measures with a specified degree of accuracy and evaluate measurements for accuracy, precision and tolerance.
4. Explain the meaning of measurements and recognize that the number of units it takes to measure an object is related to the size of the unit.	4. Interpret measurements and recognize that two objects may have the same measurement on one attribute (e.g., area) but not necessarily on another (e.g., perimeter).	4. Interpret measurements and explain how changes in one measure may affect other measures.
5. Explore scale drawings, models and maps and relate them to measurements of real objects.	5. Use proportional reasoning and indirect measurements to draw inferences.	5. Use proportional reasoning and indirect measurements, including applications of trigonometric ratios, to measure inaccessible distances and to determine derived measures such as density.
6. Apply measurement to describe the real world and to solve problems.	6. Apply measurement to describe the real world and to solve problems.	6. Apply measurement to describe the real world and to solve problems.

III. Data Analysis and Statistics

Content Standard 1: Students collect and explore data, organize data into a useful form, and develop skill in representing and reading data displayed in different formats. (Collection, Organization and Presentation of Data)

Elementary	Middle School	High School
1. Collect and explore data through counting, measuring and conducting surveys and experiments.	1. Collect and explore data through observation, measurement, surveys, sampling techniques and simulations.	1. Collect and explore data through observation, measurement, surveys, sampling techniques and simulations.
2. Organize data using concrete objects, pictures, tallies, tables, charts, diagrams and graphs.	2. Organize data using tables, charts, graphs, spreadsheets and data bases.	2 Organize data using tables, charts, graphs, spreadsheets and data bases.

3.	Present data using a variety of appropriate representations and explain the meaning of the data.	3.	Present data using a variety of appropriate representations and explain why one representation is preferred over another or how a particular representation may bias the presentation.	3.	Present data using the most appropriate representation and give a rationale for their choice; show how certain representations may skew the data or bias the presentation.
4.	Identify what data are needed to answer a particular question or solve a given problem, and design and implement strategies to obtain, organize and present those data.	4.	Identify what data are needed to answer a particular question or solve a given problem, and design and implement strategies to obtain, organize and present those data.	4.	Identify what data are needed to answer a particular question or solve a given problem and design and implement strategies to obtain, organize and present those data.

Content Standard 2: Students examine data and describe characteristics of a distribution, relate data to the situation from which they arose, and use data to answer questions convincingly and persuasively. (Description and Interpretation)

	Elementary		Middle School		High School
1.	Read and explain data they have collected and organized themselves and progress to reading data from other sources.	1.	Critically read data from tables, charts or graphs and explain the source of the data and what the data represent.	1.	Critically read data from tables, charts or graphs and explain the source of the data and what the data represent.
2.	Describe the shape of the data using informal language.	2.	Describe the shape of a data distribution and identify the center, the spread, correlations and any outliers.	2.	Describe the shape of a data distribution and determine measures of central tendency, variability and correlation.
3.	Draw, explain and justify conclusions, such as trends based on data.	3.	Draw, explain and justify conclusions based on data.	3.	Use the data and their characteristics to draw and support conclusions.
4.	Raise and answer questions about the source, collection, organization and presentation of data, as well as the conclusions drawn from the data; explore biases in the data.	4.	Critically question the sources of data; the techniques used to collect, organize and present data; the inferences drawn from the data; and the possible sources of bias in the data or their presentation.	4.	Critically question the sources of data; the techniques used to collect, organize and present data; the inferences drawn from the data; and the sources of bias and measures taken to eliminate such bias.
5.	Formulate questions and problems and gather and interpret data to answer those questions.	5.	Formulate questions and problems and gather and interpret data to answer those questions.	5.	Formulate questions and problems and gather and interpret data to answer those questions.

Content Standard 3: Students draw defensible inferences about unknown outcomes, make predictions, and identify the degree of confidence they have in their predictions. (Inference and Prediction)

	Elementary		Middle School		High School
1.	Make and test hypotheses.	1.	Make and test hypotheses.	1.	Make and test hypotheses.
2.	Conduct surveys, samplings and experiments to solve problems and answer questions of interest to them.	2.	Design experiments to model and solve problems using sampling, simulations and controlled investigations.	2.	Design investigations to model and solve problems; also employ confidence intervals and curve fitting in analyzing the data.

3. Formulate and communicate arguments and conclusions based on data and evaluate their arguments and those of others.	3. Formulate and communicate arguments and conclusions based on data and evaluate their arguments and those of others.	3. Formulate and communicate arguments and conclusions based on data and evaluate their arguments and those of others.
4. Make and explain predictions based on data.	4. Make predictions and decisions based on data, including interpolations and extrapolations.	4. Make predictions and decisions based on data, including interpolations and extrapolations.
5. Make predictions to answer questions and solve problems.	5. Employ investigations, mathematical models and simulations to make inferences and predictions to answer questions and solve problems.	5. Employ investigations, mathematical models, and simulations to make inferences and predictions to answer questions and solve problems.

IV. Number Sense and Numeration

Content Standard 1: Students experience counting and measuring activities to develop intuitive sense about numbers, develop understanding about properties of numbers, understand the need for and existence of different sets of numbers, and investigate properties of special numbers. (Concepts and Properties of Numbers)

Elementary	Middle School	High School
1. Develop an understanding of whole numbers and read, write and count using whole numbers; investigate basic concepts of fractions and decimals.	1. Develop an understanding of integers and rational numbers and represent rational numbers in both fraction and decimal form.	1. Develop an understanding of irrational, real and complex numbers.
2. Investigate and develop an understanding of the base-10 place-value system.	2. Extend their understanding of numeration systems to include decimal numeration, scientific numeration and non-decimal numeration systems.	2. Use the (a+bi) and polar forms of complex numbers.
3. Develop an understanding of the properties of numbers (e.g., order) and of the properties of the special numbers 0 and 1.	3. Develop an understanding of the properties of the integer and rational number systems (e.g., order, density) and of the properties of special numbers including 0, 1 and , and the additive and multiplicative inverses.	3. Develop an understanding of the properties of the real and complex number systems and of the properties of special numbers including , i, e, and conjugates.
4. Apply their understanding of number systems to model and solve problems.	4. Apply their understanding of number systems to model and solve mathematical and applied problems.	4. Apply their understanding of number systems to model, and solve mathematical and applied problems.

Content Standard 2: Students recognize that numbers are used in different ways such as counting, measuring, ordering and estimating, understand and produce multiple representations of a number, and translate among equivalent representations. (Representation and Uses of Numbers)

Elementary	Middle School	High School
1. Represent whole numbers, fractions and decimals using concrete, pictorial and symbolic representations.	1. Give geometric representations of fractions, prime and composite numbers, triangular and square numbers, and other number concepts; represent rational numbers and integers on the number line.	1. Give decimal representations of rational and irrational numbers and coordinate and vector representations of complex numbers.

2. Explore and recognize different representations for the same number and explain why they are the same.	2. Recognize equivalent representations of a number, especially fractions, decimals and percents, and translate freely among representations.	2. Develop an understanding of more complex representations of numbers, including exponential and logarithmic expressions, and select an appropriate representation to facilitate problem solving.
3. Investigate ways numbers are used (e.g., counting, ordering, naming, locating, measuring).	3. Distinguish between numbers that are used for counting, numbers that are used for ordering, numbers that are used for measuring and numbers that are used for naming.	3. Determine when to use rational approximations and the exact values of numbers such as e, and the irrational.
4. Develop strategies for estimating quantity and evaluate the reasonableness of their estimates.	4. Develop and refine strategies for estimating quantities, including fractional quantities, and evaluate the reasonableness and appropriateness of their estimates.	4. Apply estimation in increasingly complex situations.
5. Select appropriate numbers and representations in order to solve problems.	5. Select appropriate representations for numbers, including integers and rational numbers, in order to simplify and solve problems.	5. Select appropriate representations for numbers, including representations of rational and irrational numbers and coordinate and vector representations of complex numbers, in order to simplify and solve problems.

Content Standard 3: Students investigate relationships such as equality, inequality, inverses, factors and multiples, and represent and compare very large and very small numbers. (Number Relationships)

Elementary	Middle School	High School
1. Compare and order numbers using "equal," "less than" or "greater than."	1. Compare and order integers and rational numbers using relations of equality and inequality.	1. Compare and order real numbers and compare rational approximations to exact values.
2. Use part-whole relationships to explore numbers, develop number concepts and understand computation.	2. Express numerical comparisons as ratios and rates.	2. Express numerical comparisons as ratios and rates.
3. Classify numbers as even or odd and explore concepts of factors and multiples.	3. Distinguish between prime and composite numbers; identify factors, multiples, common factors and multiples, and relatively prime numbers; and apply divisibility tests to numbers.	3. Extend the relationships of primes, factors, multiples and divisibility in an algebraic setting.
	4. Explain the meaning of powers and roots of numbers and use calculators to compute powers and square roots.	4. Express number relationships using positive and negative rational exponents, logarithms and radicals.
5. Apply their understanding of number relationships in solving problems.	5. Apply their understanding of number relationships in solving problems.	5. Apply their understanding of number relationships in solving problems.

V. Numerical and Algebraic Operations and Analytical Thinking

Content Standard 1: Students understand and use various types of operations (e.g., addition, subtraction, multiplication, division) to solve problems. (Operations and their Properties).

Elementary	Middle School	High School
1. Use manipulatives to model operations with numbers; develop their own methods of recording operations; and relate their models and recordings to standard symbolic expressions and algorithms.	1. Use manipulatives and diagrams to model operations and their inverses with integers and rational numbers and relate the models to their symbolic expressions.	1. Present and explain geometric and symbolic models for operations with real and complex numbers and algebraic expressions.
2. Develop and apply the appropriate method of computation from among mental computation, estimation, paper-and-pencil or calculators; explain why they are choosing a method and how they know which operations to perform in a given situation.	2. Compute with integers, rational numbers and simple algebraic expressions using mental computation, estimation, calculators and paper-and-pencil; explain what they are doing and how they know which operations to perform in a given situation.	2. Compute with real numbers, complex numbers, algebraic expressions, matrices and vectors using technology and, for simple instances, with paper-and-pencil algorithms.
3. Explore properties of operations (e.g., commutative and distributive properties) and give examples of how they use those properties.	3. Describe the properties of operations with rationals and integers (e.g., closure; associative, commutative and distributive properties) and give examples of how they use those properties.	3. Describe the properties of operations with numbers, algebraic expressions, vectors and matrices, and make generalizations about the properties of given mathematical systems.
4. Apply operations efficiently and accurately in solving problems.	4. Efficiently and accurately apply operations with integers, rational numbers and simple algebraic expressions in solving problems.	4. Efficiently and accurately apply operations with real numbers, complex numbers, algebraic expressions, matrices and vectors in solving problems.

Content Standard 2: Students analyze problems to determine an appropriate process for solution, and use algebraic notations to model or represent problems. (Algebraic and Analytic Thinking)

Elementary	Middle School	High School
1. Write and solve open sentences (e.g., + = 5) and write stories to fit the open sentence.	1. Read and write algebraic expressions; develop original examples expressed verbally and algebraically; simplify expressions and translate between verbal and algebraic expressions; and solve linear equations and inequalities.	1. Identify important variables in a context, symbolize them and express their relationships algebraically.
2. Explore algebraic concepts with manipulatives such as balance scales, tables of input and output, and pictorial representations of problems.	2. Represent algebraic concepts with geometric models (e.g., algebra tiles), physical models (e.g., balance beam), tables and graphs; and write algebraic expressions to correspond to the multiple representations.	2. Represent algebraic concepts and relationships with matrices, spreadsheets, diagrams, graphs, tables, physical models, vectors, equations and inequalities; and translate among the various representations.

3. Find replacements for the variable(s) in open sentences.	3. Solve linear equalities and inequalities using algebraic and geometric methods, and use the context of the problem to interpret and explain their solutions.	3. Solve linear equations and inequalities algebraically and non-linear equations using graphing, symbol-manipulating or spreadsheet technology; and solve linear and non-linear systems using appropriate methods.
4. Use analytic thinking to describe situations and solve problems.	4. Analyze problems modeled by linear functions, determine strategies for solving the problems and evaluate the adequacy of the solutions in the context of the problems.	4. Analyze problems that can be modeled by functions, determine strategies for solving the problems and evaluate the adequacy of the solutions in the context of the problems.
	5. Explore problems that reflect the contemporary uses of mathematics in significant contexts and use the power of technology and algebraic and analytic reasoning to experience the ways mathematics is used in society.	5. Explore problems that reflect the contemporary uses of mathematics in significant contexts and use the power of technology and algebraic and analytic reasoning to experience the ways mathematics is used in society.

VI. Probability and Discrete Mathematics

Content Standard 1: Students develop an understanding of the notion of certainty and of probability as a measure of the degree of likelihood that can be assigned to a given event based on the knowledge available, and make critical judgments about claims that are made in probabilistic situations. (Probability)

Elementary	Middle School	High School
1. Explain the difference between chance and certainty and give examples to illustrate their understanding.	1. Describe events as likely or unlikely and give qualitative and quantitative descriptions of the degree of likelihood.	1. Develop an understanding of randomness and chance variation and describe chance and certainty in the language of probability.
2. Compare events and describe them as "more likely" or "less likely" and use the language of fractions to describe simple probabilities.	2. Describe probability as a measure of certainty ranging from 0 to 1 and conduct activities that allow them to express probabilities of simple events in mathematical terms.	2. Give a mathematical definition of probability and determine the probabilities of more complex events, and generate and interpret probability distributions.
3. Conduct experiments with concrete objects to explore concepts and develop an intuitive understanding of how the conditions of the experiment can affect the outcome.	3. Conduct experiments and give examples to illustrate the difference between dependent and independent events.	3. Analyze events to determine their dependence or independence and calculate probabilities of compound events.
4. Conduct experiments, record the outcomes, examine those outcomes to determine if they make sense and search for explanations of the outcomes.	4. Explain the difference between probabilities determined from experiments or chance events (empirical) and probabilities derived mathematically (theoretical), and explain how the empirical probability changes for a large number of trials.	4. Use sampling and simulations to determine empirical probabilities and, when appropriate, compare them to the corresponding theoretical probabilities; understand and apply the law of large numbers.

5. Conduct probability experiments and simulations to model and solve problems.	5. Conduct probability experiments and simulations to model and solve problems.	5. Conduct probability experiments and simulations, to model and solve problems, including compound events.

Content Standard 2: Students investigate practical situations such as scheduling, routing, sequencing, networking, organizing and classifying, and analyze ideas like recurrence relations, induction, iteration, and algorithm design. (Discrete Mathematics)

Elementary	**Middle School**	**High School**
1. Use manipulatives and diagrams to explore problems involving counting and arranging objects.	1. Use manipulatives, diagrams and the fundamental theorem of counting to count permutations and combinations.	1. Derive and use formulas for calculating permutations and combinations.
2. Explore sets and set relationships by sorting and classifying objects.	2. Use sets and set relationships to explore and solve simple algebraic and geometric problems.	2. Use sets and set relationships to represent algebraic and geometric concepts.
3. Explore situations in which they model and trace paths using figures consisting of vertices connected by edges.	3. Solve problems involving networks, for example planning delivery routes or counting paths between points.	3. Use vertex-edge graphs to solve network problems such as finding circuits, critical paths, minimum spanning trees and adjacency matrices.
4. Explore now-next patterns.	4. Explore recurrence relations and iterations.	4. Analyze and use discrete ideas, such as induction, iteration and recurrence relations.
5. Explore, develop and invent their own algorithms to accomplish a task or to solve numerical problems.	5. Continue to use manipulatives and drawings to model the concepts and procedures for the standard arithmetic algorithms, and develop and analyze their own and other students' algorithms to accomplish a task or solve a mathematical problem.	5. Describe and analyze efficient algorithms to accomplish a task or solve a problem in a variety of contexts, including practical, mathematical and computer-related situations.
6. Use discrete mathematics concepts as described above to model situations and solve problems; and look for whether or not there is a solution (existence problems), determine how many solutions there are (counting problems) and decide upon a best solution (optimization problems).	6. Use discrete mathematics concepts as described above to model situations and solve problems; and look for whether or not there is a solution (existence problems), determine how many solutions there are (counting problems) and decide upon a best solution (optimization problems).	6. Use discrete mathematics concepts as described above to model situations and solve problems; and look for whether or not there is a solution (existence problems), determine how many solutions there are (counting problems) and decide upon a best solution (optimization problems).

Science

Science is a way of making sense of the natural world. Scientists seek to describe its complexity, to explain its systems and events, and to find the patterns that allow for predictions. Science is the basis for the design of technologies that solve real-world problems.

Not all students will become scientists or engineers. But science and technology occupy ever-expanding places in our everyday lives. As citizens, we are asked to make decisions about social issues that involve science and technology. As workers, we have occupations that increasingly involve science and technology. In the 21st century, adults will need to be comfortable and competent in a complex, scientific and technological world. Schools have the responsibility of preparing students for the future. Schools must prepare all students — regardless of their future aspirations — to be scientifically literate.

Therefore, all graduates of our schools should be:

- knowledgable about the important concepts and theories of the three major branches of scientific study: earth, life, and physical sciences;

- able to think scientifically and use scientific knowledge to make decisions about real–world problems;

- able to construct new knowledge for themselves through research, reading, and discussion;

- familiar with the natural world, and respectful of its unity, diversity, and fragility;

- able to make informed judgments on statements and debates claiming to have a scientific basis; and,

- able to reflect in an informed way on the role of science in human affairs.

To make this happen, education needs to:

1. emphasize understanding, not content coverage;

2. promote learning that is useful and relevant;

3. emphasize scientific literacy for ALL students; and,

4. promote interdisciplinary learning.

The "Michigan Content Standards and Benchmarks" describe three broad categories of activities that are common in scientifically literate individuals: **using** scientific knowledge; **constructing** new scientific knowledge, and **reflecting** on scientific knowledge. The content strands are directly related to these types of activities.

Vision Statement

Overview of the Science Content Strands

Strand I. Constructing New Scientific Knowledge

*Scientifically literate students are learners as well as users of knowledge. With scientific literacy comes the ability to **ask questions** about the world that can be answered by using scientific knowledge and techniques. Scientifically literate students can also **develop solutions** to problems that they encounter or questions they ask. In developing solutions, scientifically literate students may use their own knowledge and reasoning abilities, seek out additional knowledge from other sources, and engage in empirical investigations of the real world. They can learn by **interpreting** text, graphs, tables, pictures, or other representations of scientific knowledge. Finally, scientifically literate students can remember key points and use sources of information to **reconstruct** previously learned knowledge, rather than try to remember every detail of what they study.*

Standard I.1 Constructing New Scientific Knowledge
All students will ask questions that help them learn about the world; design and conduct investigations using appropriate methodology and technology; learn from books and other sources of information; communicate their findings using appropriate technology; and reconstruct previously learned knowledge.

There is one standard under Constructing New Scientific Knowledge. This standard incorporates the ways that scientists and individuals investigate and learn about the world.

Strand II. Reflecting on Scientific Knowledge

*Scientifically literate students can also "step back" and analyze or reflect on their own knowledge. One important type of analysis is the **justification** of personal knowledge or beliefs using either theoretically or empirically based arguments. Scientifically literate students can also **show an appreciation** for scientific knowledge and the patterns that it reveals in the world; this often involves seeing **connections** among different areas of knowledge. They may be able to take a **historical and cultural perspective** on concepts and theories or to discuss institutional relationships among **science**, **technology**, and **society**. Finally, scientifically literate students can **describe the limitations** of their own knowledge and scientific knowledge in general.*

Standard II.1 Reflecting on Scientific Knowledge
All students will analyze claims for their scientific merit and explain how scientists decide what constitutes scientific knowledge; how science is related to other ways of knowing; how science and technology affect our society; and how people of diverse cultures have contributed to and influenced developments in science.

There is one standard under Reflecting on Scientific Knowledge. This standard incorporates the nature of the

scientific enterprise, its strengths, limitations, and connections to other ways of knowing.

Strand III. Using Scientific Knowledge in Life Science

*Scientifically literate students and adults can use their knowledge to understand the world around them and to guide their actions. Important types of activities that use scientific knowledge include **description** and **explanation** of real-world objects, systems, or events; **prediction** of future events or observations; and the **design** of systems or courses of action that enable people to adapt to and modify the world around them. In the life sciences, real-world contexts in which scientifically literate people use knowledge are often described in terms of **systems** and **subsystems**, such as cells, organisms, and ecosystems.*

There are five standards under Using Scientific Knowledge in Life Science:

Standard III.1 Cells

All students will apply an understanding of cells to the functioning of multicellular organisms; and explain how cells grow, develop and reproduce.

Cells are the basic living unit of which all organisms are composed.

Standard III.2 The Organization of Living Things

All students will use classification systems to describe groups of living things; compare and contrast differences in the life cycles of living things; investigate and explain how living things obtain and use energy; and analyze how parts of living things are adapted to carry out specific functions.

Organization of living things occurs both across species (as in taxonomic organizations) and within organisms (their structures and processes).

Standard III.3 Heredity

All students will investigate and explain how characteristics of living things are passed on through generations; explain why organisms within a species are different from one another; and explain how new traits can be established by changing or manipulating genes.

Heredity is the means by which traits are transmitted from one generation to the next.

Standard III.4 Evolution

All students will explain how scientists construct and scientifically test theories concerning the origin of life and evolution of species; compare ways that living organisms are adapted (suited) to survive and reproduce in their environments; and analyze how species change through time.

Evolution explains the diversity of living things and the changes seen in them over time.

Standard III.5 Ecosystems
All students will explain how parts of an ecosystem are related and how they interact; explain how energy is distributed to living things in an ecosystem; investigate and explain how communities of living things change over a period of time; describe how materials cycle through an ecosystem and get reused in the environment; and analyze how humans and the environment interact.

It is within ecosystems that communities of living things interact.

Strand IV. Using Scientific Knowledge in Physical Science

*In the physical sciences, the specification of real-world contexts often focuses on **phenomena**, such as motion, electromagnetic interactions, or physical, chemical, and nuclear changes in matter.*

Four standards are under the broad heading of Using Scientific Knowledge in Physical Science:

Standard IV.1 Matter and Energy
All students will measure and describe the things around us; explain what the world around us is made of; identify and describe forms of energy; and explain how electricity and magnetism interact with matter.

Matter and energy are the fundamental entities of the physical universe.

Standard IV.2 Changes in Matter
All students will investigate, describe and analyze ways in which matter changes; describe how living things and human technology change matter and transform energy; explain how visible changes in matter are related to atoms and molecules; and how changes in matter are related to changes in energy.

Physical, chemical, and nuclear interactions of matter and energy bring about all of the changes we observe in the physical world.

Standard IV.3 Motion of Objects
All students will describe how things around us move and explain why things move as they do; demonstrate and explain how we control the motions of objects; and relate motion to energy and energy conversions.

Motion of objects is accounted for by gravitational, electromagnetic, and nuclear forces.

Standard IV.4 Waves and Vibrations
All students will describe sounds and sound waves; explain shadows, color, and other light phenomena; measure and describe vibrations and waves; and explain how waves and vibrations transfer energy.

Sound, light, and electromagnetic waves are the means by which energy and information are propagated.

Strand V. Using Scientific Knowledge in Earth Science

*In the earth sciences, real-world contexts are often described in terms of **systems** and **subsystems**, such as atmospheric systems, crustal systems, solar systems, or galaxies, which are useful in explaining **phenomena,** including volcanic eruptions, earthquakes, thunderstorms, and eclipses.*

Four standards are under the broad heading of Using Scientific Knowledge in Earth Science:

Standard V.1 The Geosphere
All students will describe the earth's surface; describe and explain how the earth's features change over time; and analyze effects of technology on the earth's surface and resources.

The geosphere includes earth's surface and geological processes.

Standard V.2 The Hydrosphere
All students will demonstrate where water is found on earth; describe the characteristics of water and how water moves; and analyze the interaction of human activities with the hydrosphere.

The Hydrosphere includes all forms of water. Of particular interest in Michigan is the water environment in the Great Lakes region.

Standard V.3 The Atmosphere and Weather
All students will investigate and describe what makes up weather and how it changes from day to day, from season to season and over long periods of time; explain what causes different kinds of weather; and analyze the relationships between human activities and the atmosphere.

Weather is composed of patterns of moisture, temperature and pressure which move through the atmosphere.

Standard V.4 The Solar System, Galaxy and Universe
All students will compare and contrast our planet and sun to other planets and star systems; describe and explain how objects in the solar system move; explain scientific theories as to the origin of the solar system; and explain how we learn about the universe.

We learn about neighboring and remote celestial bodies through our observations and exploration of space.

Note: Essays associated with each of these standards can be found in the 1991 publication *Michigan Essential Goals and Objectives for Science Education*, available from The Center for Career and Technical Education at Michigan State University, (800) 292-1606. Each essay describes how learners encounter the standard in real-world contexts, key characteristics of scientifically literate performance of the standard, and how, with successful teaching, learners' performance of the standard becomes more sophisticated over time.

SCIENCE

CONTENT STANDARDS AND WORKING DRAFT BENCHMARKS

I. Construct New Scientific and Personal Knowledge

Content Standard 1: **All students will ask questions that help them learn about the world; design and conduct investigations using appropriate methodology and technology; learn from books and other sources of information; communicate their findings using appropriate technology; and reconstruct previously learned knowledge. (Constructing New Scientific Knowledge)**

Elementary	Middle School	High School
1. Generate reasonable questions about the world based on observation. (*Key concepts:* See Using Scientific Knowledge. *Real-world contexts:* See Using Scientific Knowledge.)	1. Generate scientific questions about the world based on observation. (*Key concepts:* See Using Scientific Knowledge. *Real-world contexts:* See Using Scientific Knowledge.)	1. Develop questions or problems for investigation that can be answered empirically. (*Key concepts:* Understanding the need to build on existing knowledge and to ask questions that can be investigated empirically. *Real-world contexts:* See Using Scientific Knowledge.)
2. Develop solutions to unfamiliar problems through reasoning, observation, and/or experiment. (*Key concepts:* See Using Scientific Knowledge. *Real-world contexts:* See Using Scientific Knowledge.)	2. Design and conduct simple investigations. (*Key concepts:* The process of scientific investigations—test, fair test, hypothesis, data, conclusion. Forms for recording and reporting data—tables, graphs, journals. *Real-world contexts:* See Using Scientific Knowledge.)	2. Suggest empirical tests of hypotheses. (*Key concepts:* Hypothesis, prediction, test, conclusion. *Real-world contexts:* See Using Scientific Knowledge.)
3. Manipulate simple mechanical devices and explain how they work. (*Key concepts:* Names and uses for parts of machines, such as levers, wheel and axles, pulleys, inclined planes, gears, screws, wedges. *Real-world contexts:* Simple mechanical devices, such as bicycles, bicycle pumps, pulleys, faucets, clothespins.)	3. Investigate toys/simple appliances and explain how they work, using instructions and appropriate safety precautions. (*Key concepts:* Safety precautions for using electrical appliances. Documentation for toys and appliances—diagrams, written instructions. *Real-world contexts:* Situations requiring assembly, use, or repair of toys, radios, or simple appliances, such as replacing batteries; connecting electrical appliances, such as stereos, videocassette recorders.)	3. Design and conduct scientific investigations. (*Key concepts:* Types of scientific knowledge—hypothesis, theory, observation, conclusion, law, data, generalization. Aspects of field research—observations, samples. Aspects of experimental research—variable, experimental group, control group, prediction, conclusion. *Real-world contexts:* See Using Scientific Knowledge.)
4. Use simple measurement devices to make metric measurement. (*Key concepts:* Measurement units—milliliters, liters, teaspoon, tablespoon, ounce, cup, millimeter, centimeter, meter, gram. *Measurement tools:* Measuring cups and spoons, measuring tape, balance or scale. *Real-world contexts*: Making simple mixtures, such as food, play dough, papier mache; measuring height of a person, mass of a ball.)		4. Diagnose possible reasons for failures of mechanical or electronic systems. (*Key concepts:* Documentation of systems, such as diagrams, owner manuals, troubleshooting guides. Procedures for identifying malfunctioning components or connections. *Real-world contexts:* Mechanical systems, such as bicycles, small appliances; electronic systems, such as videocassette recorders, stereo systems, computers.)

4. Use measurement devices to provide consistency in an investigation. (*Key concepts:* Documentation—laboratory instructions. Measurement units—milliliters, liters, teaspoon, tablespoon, ounce, cup, millimeter, centimeter, meter, gram, nonstandard units. *Measurement tools:* Balancing devices, measuring cups and spoons, measuring tape. *Real-world contexts:* Cooking for groups of various sizes; following or altering laboratory instructions for mixing chemicals.)

5. Assemble mechanical or electronic systems using appropriate tools and instructions. (*Key concepts:* Documentation of systems, such as diagrams, owner manuals, assembly instructions. *Tools:* Screwdrivers, pliers, hammers. *Real-world contexts:* Mechanical systems, such as bicycles, prepackaged furniture; electronic systems, such as videocassette recorders, stereo systems, computers.)

6. Recognize and explain the limitations of measuring devices. (*Key concepts:* Uncertainty, error, range. *Tools:* Balancing devices, measuring cups and spoons, measuring tape. *Real-world contexts:* Designing an experiment using quantitative data.)

5. Develop strategies and skills for information gathering and problem solving. (*Tools:* Sources of information, such as reference books, trade books, periodicals. *Real-world contexts:* Seeking help from peers, adults, libraries, other resources.)

5. Use sources of information to help solve problems. (*Tools:* Forms for presenting scientific information, such as figures, tables, graphs. *Real-world contexts:* Libraries, projects where research is needed.)

7. Gather and synthesize information from books and other sources of information. (*Key concepts:* Scientific periodicals, reference books, trade books. *Real-world contexts:* Libraries, technical reference books.)

6. Construct charts and graphs and prepare summaries of observations. (*Key concepts:* Increase, decrease, steady. *Tools:* Graph paper, rulers, crayons. *Real-world contexts*: Examples of simple charts and graphs like those found in a newspaper.)

6. Write and follow procedures in the form of step-by-step instructions, recipes, formulas, flow diagrams, and sketches. (*Key concepts:* Purpose, procedure, observation, conclusion. *Real-world contexts:* Following a recipe; listing or creating the directions for completing a task.)

8. Discuss topics in groups by being able to restate or summarize what others have said, ask for clarification or elaboration, and take alternative perspectives. (*Key concepts:* A newspaper or magazine article discussing a topic of social concern. *Real-world contexts:* A newspaper or magazine article discussing a topic of social concern.)

9. Reconstruct previously learned knowledge. (*Key concepts:* Appropriate scientific contexts—See Using Scientific Knowledge. *Real-world contexts:* See Using Scientific Knowledge.)

II. Reflect on the Nature, Adequacy and Connections Across Scientific Knowledge

Content Standard 1: All students will analyze claims for their scientific merit and explain how scientists decide what constitutes scientific knowledge; how science is related to other ways of knowing; how science and technology affect our society; and how people of diverse cultures have contributed to and influenced developments in science. (Reflecting on Scientific Knowledge)

Elementary	Middle School	High School
1. Develop an awareness of the need for evidence in making decisions scientifically. (*Key concepts:* Data, evidence, sample, guess, opinion. *Real-world contexts:* Deciding whether an explanation is supported by evidence in simple experiments.)	1. Evaluate the strengths and weaknesses of claims, arguments, or data. (*Key concepts:* Aspects of arguments such as data, evidence, sampling, alternate explanation, conclusion. *Real-world contexts:* Deciding between alternate explanations or plans for solving problems; evaluating advertising claims or cases made by interest groups.) 2. Describe limitations in personal knowledge. (*Key concepts:* Recognizing degrees of confidence in ideas or knowledge from different sources. *Real-world contexts:* See Using Scientific Knowledge.)	1. Justify plans or explanations on a theoretical or empirical basis. (*Key concepts:* Aspects of logical argument, including evidence, fact, opinion, assumptions, claims, conclusions, observations. *Real-world contexts:* See Using Scientific Knowledge.) 2. Describe some general limitations of scientific knowledge. (*Key concepts:* Understanding of the general limits of science and scientific knowledge as constantly developing human enterprises. *Real-world contexts:* See Using Scientific Knowledge.)
2. Show how science concepts can be interpreted through creative expression such as language arts and fine arts. (*Key concepts:* Poetry, expository work, painting, drawing, music, diagrams, graphs, charts. *Real-world contexts:* Explaining simple experiments using paintings and drawings; describing natural phenomena scientifically and poetically.)	3. Show how common themes of science, mathematics, and technology apply in real-world contexts. (*Thematic ideas:* Systems-subsystems, feedback models, mathematical constancy, scale, conservation, structure, function, adaptation. *Real-world contexts:* See Using Scientific Knowledge.)	3. Show how common themes of science, mathematics, and technology apply in real-world contexts. (*Thematic ideas:* Systems-subsystems, feedback models, mathematical constancy, scale, conservation, structure, function, adaptation. *Real-world contexts:* See Using Scientific Knowledge.) 4. Discuss the historical development of key scientific concepts and principles. (*Key concepts:* Historical, political, social, and economic factors influencing the development of science. *Real-world contexts:* Historical development of key scientific theories, such as evolution, the germ theory of disease, principles of genetics, plate tectonics, atomic theory, Newtonian physics.)

3. Describe ways in which technology is used in everyday life. (*Key concepts:* Provide faster and farther transportation and communication, organize information and solves problems, save time. *Real-world contexts:* Cars, other machines, radios, telephones, computer games, calculators, appliances.)

4. Develop an awareness of and sensitivity to the natural world. (*Key concepts:* Appreciation of the balance of nature and the effects organisms have on each other, including the effects humans have on the natural world. *Real-world contexts:* See Using Scientific Knowledge.)

4. Describe the advantages and risks of new technologies. (*Key concepts:* Risk, benefit, side effect, advantage, disadvantage. *Real-world contexts:* Technological systems for manufacturing, transportation, energy distribution, housing.)

5. Evaluate alternative long range plans for resource use and by-product disposal in terms of environmental and economic impact. (*Key concepts:* Understanding of limitations of knowledge and technology, side effects of resource use. *Real-world contexts:* Large scale systems for mining, energy use, manufacturing, transportation, housing.)

5. Develop an awareness of contributions made to science by people of diverse backgrounds. (*Key concepts:* Scientific contributions made by people of diverse cultures and backgrounds. *Real-world contexts:* See Using Scientific Knowledge.)

5. Recognize the contributions made in science by cultures and individuals of diverse backgrounds. (*Key concepts:* Scientific contributions made by people of diverse cultures and backgrounds. *Real-world contexts:* See Using Scientific Knowledge.)

6. Describe the historical, political, and social factors affecting developments in science. (*Key concepts:* Historical, political, social, and economic factors influencing the development of science. *Real-world contexts:* An example might be the development of the sun-centered model of the solar system.)

III. Use Scientific Knowledge from the Life Sciences in Real-World Contexts

Content Standard 1: All students will apply an understanding of cells to the functioning of multicellular organisms; and explain how cells grow, develop and reproduce. (Cells)

Elementary	**Middle School**	**High School**
1. Describe cells as living systems. (*Key concepts:* Life functions—growth, development, reproduction, response to environment, movement. All parts of living things are made of cells. *Real-world contexts:* Common plant, animal or protist cells: Elodea leaf cells, onion skin cells, human cheek cells, Paramecium.)	1. Describe similarities/ differences between single-celled and multicellular organisms. (*Key concepts:* Differences—single-celled, multicellular, cell specialization. Cell structures—nucleus, cytoplasm, cell wall, cell membrane. *Observation tools*: Hand lens, microscope. *Real-world contexts:* Common examples of protists: Amoeba, Paramecium; common examples of specialized cells of multicellular organisms—leaf cells root cells, stem cells, blood cells, muscle cells, nerve cells.)	1. Classify cells/organisms on the basis of organelle and/or cell types. (*Key concepts:* Cell parts used for classification—organelle, nucleus, cell wall, cell membrane. *Real-world contexts:* Selected plant and animal cells, see above, and bacteria.) 2. Explain how multicellular organisms grow, based on how cells grow and reproduce. (*Key concepts:* Specialized functions of cells—respiration, synthesis, mitosis, meiosis. *Real-world contexts:* A-V media or models showing embryo development.)

2. Explain why specialized cells are needed by plants and animals. (*Key concepts:* Specialized functions of cells—reproduction, photosynthesis, transport. *Real-world contexts:* Specialized animal cells: red blood cells, white blood cells; specialized plant cells—root cells, leaf cells, stem cells.)

3. Compare and contrast ways in which selected cells are specialized to carry out particular life functions. (*Key concepts:* Specialized functions—reproduction, photosynthesis, transport. *Real-world contexts:* Specialized plant and animal cells—red blood cells, white blood cells, muscle cells, nerve cells, root cells, leaf cells, stem cells.)

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3. Explain how cells use food as a source of energy. (*Key concepts:* How cells use food—food, molecule, respiration, oxygen, carbon dioxide, water. *Real-world contexts:* Experiments/demonstrations showing reactants/products of respiration and photosynthesis.)

4. Compare and contrast the chemical composition of selected cell types. (*Key concepts:* Basic chemicals/molecules—water, minerals, carbohydrates, proteins, fats and lipids, nucleic acids. Atoms—carbon, hydrogen, oxygen, nitrogen. *Real-world contexts:* Bacteria and selected plant and animal cells; see above.)

5. Compare the transformations of matter and energy during photosynthesis and respiration. (*Key concepts:* Cell Processes—photosynthesis, cellular respiration. Reactants and products—carbon dioxide, oxygen, sugar, water. Energy forms—heat, light, food (chemical) energy. *Real-world contexts:* Phenomena that provide evidence of matter and energy transformations, such as oxygen bubbles on plants in an aquarium, condensation on sides of a terrarium, starch storage in plants grown under different conditions.)

6. Explain how essential materials move into cells and how waste and other materials get out. (*Key concepts:* How materials pass in and out of cells—osmosis, diffusion. *Real-world contexts:* A-V media or models showing materials moving into and out of cells; other contexts, such as—Amoeba or Paramecium "eating," dialysis tubing with a starch/glucose solution in a beaker of water, celery stalk in salt water.)

7. Explain how cells use food to grow. (*Key concepts:* Basic molecules for growth—simple sugars, amino acids, fatty acids. Basic chemicals, molecules and atoms—water, minerals, carbohydrates, proteins, fats and lipids, nucleic acids; carbon, hydrogen, oxygen, nitrogen. *Real-world contexts:* A-V media or models showing how basic molecules are combined to make complex molecules.)

Content Standard 2: All students will use classification systems to describe groups of living things; compare and contrast differences in the life cycles of living things; investigate and explain how living things obtain and use energy; and analyze how parts of living things are adapted to carry out specific functions. (Organization of Living Things)

Elementary	Middle School	High School
1. Compare and classify familiar organisms on the basis of observable physical characteristics. (*Key concepts:* Plant and animal parts—backbone, skin, shell, limbs, roots, leaves, stems, flowers. *Real-world contexts:* Animals that look similar—snakes, worms, millipedes; flowering and nonflowering plants; pine tree, oak tree, rose, algae.) 2. Describe vertebrates in terms of observable body parts and characteristics. (*Key concepts:* Vertebrate characteristics—fur, scales, feathers, horns, claws, eyes, quills, beaks, teeth, skeleton, muscles, cells. *Real-world contexts:* Vertebrate and nonvertebrate animals, such as humans, cow, sparrow, goldfish, spider, starfish, and animals listed above.)	1. Compare and classify organisms into major groups on the basis of their structure. (*Key concepts:* Characteristics used for classification— vertebrates/invertebrates, cold-blooded/warm-blooded, single-cell/multicellular, flowering/nonflowering. *Real-world contexts:* Representative organisms, such as dog, worm, snake, Amoeba, geranium, wheat.)	1. Classify major groups of organisms on the basis of the five-kingdom system. (*Key concepts:* Kingdom categories—protist, fungi, moneran, animal, plant. Characteristics for classification—cell wall, cell membrane, heterotroph, autograph, organelle, single-celled, multicellular. *Real-world contexts:* Common local representatives of each of the five major kingdoms—Paramecium, yeast, mushroom, bacteria, frog, geranium.)
3. Describe life cycles of familiar organisms. (*Key concepts:* Life cycle stages—egg, young, adult, seed, flower, fruit. *Real-world contexts:* Common plants and animals such as beans, apples, butterflies, grasshoppers frogs, birds.)	2. Describe the life cycle of a flowering plant. (*Key concepts:* Flowering plant parts and processes—roots, stems, leaves, flowers, fruits, seeds, embryo, pollen, ovary, egg cell, germination, fertilization. *Real-world contexts:* Common flowering plants, such as bean, tulip.)	2. Describe the life cycle of an organism associated with human disease. (*Key concepts:* Infection process—disease, parasite, host, infection. *Observation tools:* Microscope, hand lens. *Real-world contexts:* Life cycle of organism(s) associated with a human disease(s), such as Lyme disease—tick, malaria—mosquito, parasites—like hookworm.)

4. Compare and contrast food, energy, and environmental needs of selected organisms. (*Key concepts:* Life requirements—food, air, water, minerals, sunlight, space, habitat. *Real-world contexts:* Germinating seeds, such as beans, corn; aquarium or terrarium life, such as guppy, goldfish, snail.)

3. Describe evidence that plants make and store food. (*Key concepts:* Process and products of food production—photosynthesis, starch, sugar, oxygen. *Real-world contexts:* Plant food storage organs, such as potato, onion; starch storage in plants grown under different conditions.)

3. Explain the process of food storage and food use in organisms. (*Key concepts:* Food storage and use in organisms—photosynthesis, cellular respiration, oxygen, sunlight, carbon dioxide, carbohydrate, fat, protein, minerals, water. *Real-world contexts:* Food storage, such as maple tree—maple sap, potato—starch, honey bee—honey, cow—beef, milk.)

5. Describe functions of selected seed plant parts. (*Key concepts:* Plant parts—roots, stems, leaves, flowers, fruits, seeds. *Real-world contexts:* Common edible plant parts, such as bean, cauliflower, carrot, apple, tomato, spinach.)

4. Explain how selected systems and processes work together in plants and animals. (*Key concepts:* Systems/Processes—digestion, circulation, respiration, endocrine, reproduction, skeletal, muscular, nervous, excretion, transport, growth, repair. *Real-world contexts:* Interrelations of body systems during selected activities, such as among skeletal, muscular, circulatory, and respiratory systems during physical exercise.)

4. Explain how living things maintain a stable internal environment. (*Key concepts:* Related systems/cells/ chemicals—excretory system, endocrine system, circulatory system, hormones, immune response, white blood cell, bacteria, virus. Factors/ mechanisms under control—temperature, disease/infection. *Real-world contexts:* Mechanisms for maintaining internal stability, such as body temperature, disease control.)

5. Describe technology used in the prevention, diagnosis, and treatment of diseases. (*Key concepts:* Available technologies—sanitation, adequate food and water supplies, inoculation, antibodies, biochemistry, medicines, organ transplants. *Real-world contexts:* Common contexts for these technologies—health maintenance and disease prevention activities, such as exercise and controlled diets; health monitoring activities, such as cholesterol and blood pressure checks and various tests for cancer.)

Content Standard 3: All students will investigate and explain how characteristics of living things are passed on through generations; explain why organisms within a species are different from one another; and explain how new traits can be established by changing or manipulating genes. (Heredity)

Elementary	Middle School	High School
1. Give evidence that characteristics are passed from parents to young. (*Key concepts:* Participants—parent, young. Characteristics—hair color, eye color, skin color, leaf shape, leaf size. *Real-world contexts:* Example of mature and immature organisms, such as dogs/puppies, cats/kittens, maple trees/saplings, beans/seedlings.)	1. Describe how the characteristics of living things are passed on through generations. (*Key concepts:* Reproductive cells—egg, sperm. Cell parts—nucleus, gene. *Real-world contexts:* Common traits controlled by a single gene pair, such as wrinkled or smooth seeds in a pea plant, color of horse hair.)	1. Explain how characteristics of living things are passed on from generation to generation. (*Key concepts:* Traits—dominant, recessive. Genetic material—gene pair, gene combination, gene sorting. Genetic changes—variation, mutation. *Real-world contexts:* Common contexts—inheritance of a human genetic disease/disorder, such as sickle cell anemia; a family tree focused on certain traits; examining animal or plant pedigrees.)
	2. Describe how heredity and environment may influence/determine characteristics of an organism. (*Key concepts:* Traits—inherited, acquired. *Real-world contexts:* Data on heredity, such as identical twin studies, effects of introduced toxins, effects of natural selection, effects of controlled selection and breeding.)	2. Describe how genetic material is passed from parent to young during sexual and asexual reproduction. (*Key concepts:* Types of cell division—mitosis, meiosis. Types of reproduction—sexual, asexual. *Real-world contexts:* A-V media, diagrams showing DNA replication during cell division.)
		3. Explain how new traits may be established in individuals/ populations through changes in genetic material (DNA). (*Key concepts:* Natural and human-produced sources of mutation—radiation, chemicals. *Real-world contexts:* Products of genetic engineering, such as medical advances—insulin, cancer drugs; agricultural related products, such as navel oranges, new flower colors, higher-yield grains; effects of natural and man-made contamination.)

Content Standard 4: All students will explain how scientists construct and scientifically test theories concerning the origin of life and evolution of species; compare ways that living organisms are adapted (suited) to survive and reproduce in their environments; and analyze how species change through time. (Evolution)

Elementary	Middle School	High School
1. Explain how fossils provide evidence about the nature of ancient life. (*Key concepts:* Types of evidence—fossil, extinct, ancient, modern life forms. *Real-world contexts:* Common contexts—plant and animal fossils, museum dioramas and paintings/drawings of ancient life and/or habitats.)	1. Describe how scientific theory traces possible evolutionary relationships among present and past life forms. (*Key concepts:* Selected evidence of common ancestry—geologic time, fossil, bone, embryo, limb. *Real-world contexts:* A-V media, models of fossils that show evidence of common ancestry, such as similarity of vertebrate limb bones, similarity of early vertebrate embryos, similarity of fossil bones to those of contemporary animals i.e., horse legs.)	1. Describe what biologists consider to be evidence for human evolutionary relationships to selected animal groups. (*Key concepts:* Common types of evidence used—hominid fossils, vestigial structures. *Real-world contexts:* Skeletal comparisons, such as modern human to hominid fossils; anatomical and biochemical similarities of humans and other higher primates, such as blood proteins; similarity of early human embryo stages to those of other vertebrates; vestigial structures, such as appendix, tail bone.)
2. Explain how physical and/or behavioral characteristics of organisms help them to survive in their environments. (*Key concepts:* Characteristics—adaptation, fitness, instinct, learning, habit. Traits and their adaptive values—sharp teeth or claws for catching and killing prey, color for camouflage. *Real-world contexts:* Common vertebrate adaptations, such as white polar bears, sharp claws and sharp canines for predators, changing colors of chameleon; behaviors, such as migration, communication of danger, adaptation to changes in the environment.)		2. Explain how a new species or variety may originate through the evolutionary process of natural selection. (*Key concepts:* How new species or varieties are established—natural selection, inheritable, non-inheritable characteristics, species variation. *Real-world contexts:* Common contexts—contemporary examples of natural selection, such as bacteria resistance to antibiotics, insect resistance to pesticides; examples of artificial selection, such as agricultural selection to increase production, selecting desired traits for pets; examining pros and cons; historical examples of natural selection, such as possible evolution of the giraffe.)

3. Explain how new traits might arise and become established in a population. (*Key concepts:* Sources of variation—mutation of DNA, new gene combinations. *Real-world contexts:* Examples of inheritable and non-inheritable variations due to mutations or environmental conditions, such as white-eyed fruit fly or scars; examples of variations due to new gene combinations, such as hybrid organisms or new plant varieties resulting from multiple sets of genes.)

Content Standard 5: All students will explain how parts of an ecosystem are related and how they interact; explain how energy is distributed to living things in an ecosystem; investigate and explain how communities of living things change over a period of time; describe how materials cycle through an ecosystem and get reused in the environment; and analyze how humans and the environment interact. (Ecosystems)

Elementary	**Middle School**	**High School**
1. Identify familiar organisms as part of a food chain or food web and describe their feeding relationships within the web. (*Key concepts:* Producer, consumer, predator, prey, decomposer, habitat. *Real-world contexts:* Food chains and food webs involving organisms, such as rabbits, birds, snakes, grasshoppers, plants.)	1. Describe common patterns of relationships among populations. (*Key concepts:* Participants and relationships—predator, prey, parasitism, competition, symbiosis. *Real-world contexts:* Examples of predator-prey, symbiotic, and parasitic relationships—see elementary benchmarks 1 and 2; examples of competitive relationships, including squirrels and seed-eating birds, cattle and bison.)	1. Describe common ecological relationships among species. (*Key concepts:* Competition, territory, carrying capacity, natural balance, population, dependence, survival. *Real-world contexts:* Animals that live in packs or herds and plant colonies, such as—wolves, bison, lilies and other bulb plants, various forms of algae; selected ecosystems—see elementary benchmark 3.)
2. Explain common patterns of interdependence and interrelationships of living things. (*Key concepts:* Producer, consumer, predator, prey, decomposer, habitat. *Real-world contexts:* Relationships among plants and animals in an ecosystem—symbiotic relationships, such as insects and flowering plants, birds eating fruit and spreading seeds; parasitic relationships, such as human and mosquitoes, trees and mistletoe.)		

3. Describe the basic requirements for all living things to maintain their existence. (*Key concepts:* Needs of life—food, habitat, water, shelter, air, light, minerals. *Real-world contexts:* Selected ecosystems, such as an aquarium, rotting log, terrarium, backyard, local pond or wetland, wood lot.)

2. Predict the effects of changes in one population in a food web on other populations. (*Key concepts:* Natural balance, population, dependence, survival. *Real-world contexts:* Plants and animals in an ecosystem dependent upon each other for survival in selected ecosystems—see elementary benchmark 3; comparison of animals and plants found in polluted vs. nonpolluted water, urban vs. rural settings, rural vs. forest settings.)

3. Describe how all organisms in an ecosystem acquire energy directly or indirectly from sunlight. (*Key concepts:* Sunlight, plants, food, photosynthesis, heat. *Real-world contexts:* Selected food chains, including humans; also see Cells benchmarks related to photosynthesis.)

2. Explain how energy flows through familiar ecosystems. (*Key concepts:* Participants and relationships—food chain, food web, energy pyramid, energy flow, producers, consumers, decomposers. *Real-world contexts:* Energy pyramids for food chains in selected ecosystems—also see elementary benchmark 3.)

4. Design systems that encourage growing of particular plants or animals. (*Key concepts:* Needs of life—food, habitat, water, shelter, air, light, minerals. *Real-world contexts:* Ecosystems managed by humans, including farms, ranches, gardens, lawns, potted plants.)

4. Describe the likely succession of a given ecosystem over time. (*Key concepts:* Succession, stages, climax community. *Real-world contexts:* Process of gradual change in ecological systems, such as in ponds or abandoned farm fields.)

3. Describe general factors regulating population size in ecosystems. (*Key concepts:* Carrying capacity, competition, parasitism, predation. *Real-world contexts:* Common factors that influence relationships, such as weather, disease, predation, migration.)

4. Describe responses of an ecosystem to events that cause it to change. (*Key concepts:* Succession, climate/physical conditions, introduction of new/different species, elimination of existing species. *Real-world contexts:* Climax forests comprised of maple, beech, or conifers; effects of urban sprawl or clear cutting forests; selected ecosystems—see elementary benchmark 3.)

5. Identify some common materials that cycle through the environment. (*Key concepts:* Carbon cycle and water cycle—water, carbon dioxide, oxygen, sugar (food). Also see appropriate Cells and Atmosphere and Weather benchmarks. *Real-world contexts:* Selected ecosystems—also see elementary benchmark 3.)

5. Describe how water, carbon dioxide, and soil nutrients cycle through selected ecosystems. (*Key concepts:* Common nutrients/elements—nitrogen, sulfur, carbon, phosphorous. Inorganic compounds containing nutrients—oil minerals, carbon dioxide. Organic compounds in living communities—proteins, fats, carbohydrates. Also see appropriate Cells benchmarks. *Real-world contexts:* Selected ecosystems—see middle school benchmark 5; also see appropriate Hydrosphere benchmarks.)

5. Describe positive and negative effects of humans on the environment. (*Key concepts:* Human effects on the environment—garbage, habitat destruction, land management, resource management. *Real-world contexts:* Household wastes, school wastes, waste water treatment, habitat destruction due to community growth, reforestation projects, establishing parks or other green spaces.)

6. Describe ways in which humans alter the environment. (*Key concepts:* Agriculture, land use, resource development, resource use, solid waste, toxic waste. *Real-world contexts:* Human activities, such as farming, pollution from manufacturing and other sources, hunting, habitat destruction, land development.)

7. Explain how humans use and benefit from plant and animal materials. (*Key concepts:* Materials from plants, including—wood, paper, cotton, linen, starch, rubber, wax, and oils. Materials from animals, including leather, wool, fur, protein, oils, wax. *Real-world contexts:* Human-made objects that incorporate plant and animal materials, including clothing, building materials, machines, and medicines—also see elementary benchmark 1, and middle shool benchmarks 3 and 6—also see appropriate Geosphere benchmarks.)

6. Explain the effects of agriculture and other human activities on selected ecosystems. (*Key concepts:* Common factors that influence ecosystems, such as pollution of ecosystems from fertilizer, insecticide, and other chemicals. *Real-world contexts:* Common factors that influence ecosystems, such as pollution of ecosystems from fertilizer, insecticide, and other chemicals.)

IV. Use Scientific Knowledge from the Physical Sciences in Real-World Contexts

Content Standard 1: All students will measure and describe the things around us; explain what the world around us is made of; identify and describe forms of energy; and explain how electricity and magnetism interact with matter. (Matter and Energy)

Elementary	Middle School	High School
1. Classify common objects and substances according to observable attributes: color, size, shape, smell, hardness, texture, flexibility, length, weight, buoyancy, states of matter, or magnetic properties. (*Key concepts:* Texture—rough, smooth. Flexibility—rigid, stiff, firm, flexible, strong. Smell—pleasant, unpleasant. States of matter—solid, liquid, gas. Magnetic properties—attract, repel, push, pull. Size—large, small, larger, smaller. Buoyancy—sink, float. Color—common color words. Shape—circle, square, triangle, rectangle, oval. Weight—heavy, light, heavier, lighter. *Real-world contexts:* Common objects, such as desks, coins, pencils, buildings, snowflakes; common substances, including—solids, such as copper, iron, wood, plastic, Styrofoam; liquids, such as water, alcohol, milk, juice, gasoline; gases such as air, helium, water vapor.)	1. Measure physical properties of objects or substances (mass, weight, area, temperature, dimensions, volume). (*Key concepts:* Units of measure—kilogram, gram, liter, degrees Fahrenheit, degrees Celsius. *Measurement tools:* Balances, spring scales, measuring cups or graduated cylinders, thermometers, metric ruler. *Real-world contexts:* Common substances such as those listed in elementary benchmark 1; hot and cold substances, such as ice, snow, cold water, hot water, steam, cold air, hot air.)	1. Describe and compare objects in terms of mass, volume, and density. (*Key concepts:* Units of density—grams per cubic centimeter or grams per milli-liter. *Measurement tools and units describing mass and volume:* Balances, spring scales, measuring cups or graduated cylinders, thermometers, metric ruler; kilogram, gram, liter, degrees Fahrenheit, degrees Celsius. *Real-world contexts:* Common objects and substances—see above; events involving floating and sinking, such as wood floating in water, oil and water, hot air balloons, submarines, lake turnover.)
2. Measure weight, dimensions, and temperature of appropriate objects and materials. (*Key concepts:* Linear dimensions—length, width, height, long, short, wide, narrow, tall, short, taller, shorter. Units of measure (both standard and nonstandard)—meters, centimeters, others. *Measurement tools:* Ruler, meter stick, balance or scale, thermometer. *Real-world contexts:* Common objects such as those listed above.)	2. Describe when length, mass, weight, area, or volume are appropriate to describe the size of an object or the amount of a substance. (*Key concepts:* Length, mass, weight, area, volume. Array of measuring devices, metric ruler, graduated cylinders, balances, spring scale. *Real-world contexts:* Common objects—see elementary benchmark 1.) 3. Classify substances as elements, compounds, or mixtures. (*Key concepts:* Element, compound, mixture. *Real-world contexts:* Common substances such as those listed above, including—elements, such as copper, aluminum, sulfur, helium, iron; compounds, such as water, salt, sugar, carbon dioxide; mixtures, such as soil, salt and pepper, salt water.)	2. Explain how families of elements are related by common properties. (*Tools:* Periodic table of elements. *Materials:* various element samples. *Real-world contexts:* Common elements—calcium, magnesium, sulfur, oxygen chlorine, iodine, silicon, carbon; properties of elements which make them useful in technological systems.) 3. Analyze properties of common household and agricultural materials in terms of risk/benefit balance. (*Key concepts:* Risk/benefit analysis. *Real-world contexts:* Herbicides, refrigerants, fertilizers, detergents.)

3. Identify properties of materials which make them useful. (*Key concepts:* Useful properties—unbreakable, waterproof, light, conducts electricity, conducts heat, attracted to a magnet. *Real-world contexts:* Appropriate selection of materials for a particular use, such as waterproof raincoat, cotton or wool for clothing, glass for windows, metal pan to conduct heat, copper wire to conduct electricity.)

4. Describe matter as consisting of extremely small particles (atoms) which bond together to form molecules. (*Key concepts:* Molecule, particle, matter, bond, atom. *Real-world contexts:* Common substances such as those listed above.)

5. Describe the arrangement and motion of molecules in solids, liquids, and gases. (*Key concepts:* Arrangement—regular pattern, random. Distance between molecules—closely packed, separated. Molecular motion—vibrating, bumping together, moving freely. *Real-world contexts:* Common solids, liquids, and gases, such as those listed above.)

4. Describe and explain the structural parts and electrical charges of atoms. (*Key concepts:* Parts of atoms—nucleus, electron cloud. Subatomic particles—proton, neutron, electron. Electrical charges—positive, negative, neutral. *Real-world contexts:* All elements, relationships from Periodic Table.)

4. Identify forms of energy associated with common phenomena. (*Key concepts:* Energy, work, heat, sound, food energy, energy of motion, electrical. *Real-world contexts:* Appropriate selection of energy and phenomena, such as appliances like a toaster or iron that use electricity, sun's heat to melt chocolate, water wheels, wind-up toys, warmth of sun on skin, windmills, music from guitar.)

6. Describe energy and the many common forms it takes (mechanical, heat, light, sound, electrical, magnetic, chemical, nuclear). (*Key concepts:* Forms of energy—mechanical, heat, sound, light, electrical, magnetic, chemical, nuclear, food energy. *Real-world contexts:* Body heat, heating a home, using light to see, using sound to hear, eating food, using electricity for appliances, gasoline for cars, nuclear power.)

7. Describe how common forms of energy can be converted, one to another. (*Key concepts:* Forms of energy—mechanical, heat, sound, light, electrical, magnetic, chemical, nuclear, food energy. Conservation of energy. Energy transformation. *Real-world contexts:* Motors, generators, power plants, lightbulbs, appliances, cars, walking, playing a musical instrument, cooking food.)

5. Describe how energy is conserved during transformations. (*Key concepts:* Law of conservation of energy. *Real-world contexts:* Motors, generators, power plants, light bulbs, appliances, cars, radios, lifting an object, roller coaster, human body systems.)

6. Explain changes in matter and energy involving heat transfer. (*Key concepts:* Mechanisms of heat transfer—convection, conduction, radiation. Efficiency. *Real-world contexts:* Convection currents, lake turnover, wind, hot frying pans, heating and cooling buildings, heat lamps, sunlight heating the earth.)

5. Describe the interaction of magnetic materials with other magnetic and non-magnetic materials. (*Key concepts:* Magnetic/non-magnetic, magnetic poles, magnetic attraction and repulsion. *Tools:* Magnetic compass. *Real-world contexts:* Common magnets, using a magnetic compass to find direction.)

6. Describe the interaction of charged materials with other charged or uncharged materials. (*Key concepts:* Charging by rubbing or touching, electric attraction and repulsion. *Real-world contexts:* Static cling, lightning, sparks.)

7. Describe possible electrical hazards to be avoided at home and at school. (*Key concepts:* Shock, wall outlet, hazards. *Real-world contexts:* Electric outlets, power lines, frayed electric cords, electric appliances, lightning.)

8. Describe electron flow in simple electrical circuits. (*Key concepts:* Complete circuit, open circuit, closed circuit. *Real-world contexts:* Household wiring, electrical conductivity testing, flashlight, electric appliances.)

9. Use electric currents to create magnetic fields. (*Key concepts:* Electric current, magnetic poles, magnetic fields. *Tools:* Magnetic compass, battery, wire. *Real-world contexts:* Electromagnets, bells, speakers, motors, magnetic switches, Earth's magnetic field.)

7. Describe how electric currents can be produced by interacting wires and magnets. (*Key concepts:* Electromagnetic induction, current flow and direction, magnetic fields. *Real-world contexts:* Generators, transformers.)

8. Construct and explain simple circuits using wires, light bulbs, fuses, switches, and power sources. (*Key concepts:* Complete circuit, short circuit, series circuit, parallel circuits, open circuit, closed circuit, power supply, batteries, dry cells, fuses, switches, current, power, electric potential. *Real-world contexts:* Household wiring, automobile wiring, flashlights, tree lights.)

Content Standard 2: All students will investigate, describe and analyze ways in which matter changes; describe how living things and human technology change matter and transform energy; explain how visible changes in matter are related to atoms and molecules; and how changes in matter are related to changes in energy. (Changes in Matter)

Elementary	**Middle School**	**High School**
1. Describe common physical changes in matter—size, shape, melting, freezing, dissolving. (*Key concepts:* States of matter—solid, liquid, gas. Changes in size and shape—bending, tearing, breaking. Changes in state of matter—melting, freezing, dissolving, invisible heat source. *Real-world contexts:* Changes in size or shape of familiar objects, such as making snowballs, breaking glass, crumbling cookies, making clay models, carving wood, breaking bones; changes in state of water or other substances, such as freezing of ice cream, or ponds, melting wax or steel.)	1. Describe common physical changes in materials: evaporation, condensation, thermal expansion, and contraction. (*Key concepts:* States of matter—solid, liquid, gas. Changes in states of matter—evaporation, condensation. Thermal expansion and contraction. *Real-world contexts:* States of matter—solid, liquid, gas. Changes in state, such as water evaporating as clothes dry, condensation on cold window panes; expansion of bridges in hot weather.)	1. Explain how mass is conserved in physical and chemical changes. (*Key concepts:* Law of conservation of mass. *Real-world contexts:* Common physical and chemical changes above; see elementary benchmark 1, and middle school benchmarks 1, 2, and 3.)
		2. Describe nuclear changes in terms of the properties of reactants and products. (*Key concepts:* Nucleus, nuclear change, nuclear energy. *Real-world contexts:* Nuclear power plants, nuclear energy from sun, natural radioactive decay.)

2. Prepare mixtures and separate them into their component parts. (*Key concepts:* Mixture, solution. Separation techniques—filtration, using sieves, dissolving soluble substances, magnets, floating vs. sinking, distillation. *Tools:* Filter paper, funnels, magnets, sieves, beakers, solar stills. *Real-world contexts:* Mixtures of various kinds—salt and pepper, iron filings and sand, sand and sugar, rocks and wood chips, sand and gravel.)

2. Describe common chemical changes in terms of properties of reactants and products. (*Key concepts:* Common chemical changes—burning paper, rusting iron, formation of sugars during photosynthesis. *Real-world contexts:* Chemical changes—burning, photosynthesis, digestion, corrosion.)

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3. Construct simple objects that fulfill a technological purpose. (*Materials:* Rubber bands, paper, corks, scrap wood. *Real-world contexts:* Simple bridges, boats, planes, ramps that can be made from common materials.)

3. Distinguish between physical and chemical changes in natural and technological systems. (*Key concepts:* Changes in matter—physical changes and chemical changes. *Real-world contexts:* Natural physical and chemical changes—water cycle, chewing, erosion, corrosion, photosynthesis, respiration; technological physical and chemical changes—dehydrated foods, solid air fresheners, recycling glass, burning fuels, manufacturing plastics.)

4. Describe how waste products accumulating from natural and technological activity create pollution. (*Key concepts:* Manufacturing, distribution, refining, mining, landfill, water treatment. *Real-world contexts:* Many sources of pollution, both natural and technological.)

3. Trace, to an original source, the energy used by living things and machines. (*Key concepts:* Food, fuel, renewable and non-renewable resources. *Real-world contexts:* Fossil fuels, nuclear energy, sun, electricity, manufacturing, transportation, digestion, photosynthesis.)

4. Describe how common materials are made and disposed of or recycled. (*Key concepts:* Descriptions of physical and chemical changes. Manufacturing—refining, mining, waste disposal. *Real-world contexts:* Manufacturing processes—steel mills, auto assembly lines, paper making; recycling—glass, aluminum, paper, plastic, water treatment; disposal—landfills, incinerators.)

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5. Explain physical changes in terms of the arrangement and motion of atoms and molecules. (*Key concepts:* Molecular descriptions of states of matter—also see Matter and Energy benchmarks. Physical changes—States of matter (solid, liquid, gas). Changes in size and shape—bending, tearing, breaking. Changes in state of matter—melting, freezing, evaporation, condensation. Thermal expansion and contraction. Speed of molecular motion—moving faster, slower, vibrate, rotate, unrestricted motion, conservation of matter. *Real-world contexts:* See examples of Physical Changes of Matter, elementary benchmark 1 and middle school benchmark 3.)

5. Explain chemical changes in terms of the arrangement and motion of atoms and molecules. (*Key concepts:* Description of chemical change at molecular level, see Matter and Energy benchmarks. Description of chemical change—burning paper, rusting iron, formation of sugars during photosynthesis, atom, molecule, bond, reactant, product, conservation of matter. *Real-world contexts:* Examples of chemical change—see middle school benchmarks 2 and 3.)

		6. Describe, compare, and contrast changes in atoms and/or molecules during physical, chemical, and nuclear changes. (*Key concepts:* Atomic/molecular descriptions of physical and chemical substances and changes. Also see, Matter and Energy benchmarks. *Real-world contexts:* Physical and chemical changes in natural and technological systems; nuclear changes—nuclear power plants, bombs, natural radioactive decay, medical use of isotopes, nuclear reactions in the sun.)
		7. Describe energy changes associated with physical and chemical changes. (*Key concepts:* Physical change, chemical change, potential energy, kinetic energy. *Real-world contexts:* Physical changes—dehydrated foods, solid air fresheners, recycling glass; chemical changes—some hot and cold packs, burning fuels, corrosion.)
		8. Describe, compare and contrast relative magnitudes of energy changes involved in physical, chemical and nuclear changes. (*Key concepts:* Physical change, chemical change, potential energy, kinetic energy. *Real-world contexts:* See high school benchmarks 5 and 6.)

Content Standard 3: All students will describe how things around us move and explain why things move as they do; demonstrate and explain how we control the motions of objects; and relate motion to energy and energy conversions. (Motion of Objects)

Elementary	Middle School	High School
1. Describe or compare motions of common objects in terms of speed and direction. (*Key concepts:* Words—east, west, north, south, right, left. Speed words—fast, slow, faster, slower. *Real-world contexts:* Motions of familiar objects in two dimensions, including rolling or thrown balls, wheeled vehicles, sliding objects.)	1. Qualitatively describe and compare motions in three dimensions. (*Key concepts:* Three-dimensional motion—up, down, curved path. *Real-world contexts:* Objects moving in three dimensions, such as thrown balls, roller coasters, cars on hills, airplanes.)	1. Perform measurements and calculations to describe the speed and direction of an object. (*Key concepts:* Units of measure—meter, kilometer, seconds, hour, meters/sec, kilometers/hour. Measurement instruments—rulers, tape measures, stopwatches, clocks, speedometers, compasses. *Real-world contexts:* Common objects moving in two or three dimensions—see middle school benchmark 1.)

2. Describe how forces (pushes or pulls) are needed to speed up, slow down, stop, or change the direction of a moving object. (*Key concepts:* Changes in motion—speeding up, slowing down, turning. Common forces—push, pull, friction, gravity. *Real-world contexts:* Playing ball, moving chairs, sliding objects.)

2. Relate changes in speed or direction to unbalanced forces in two dimensions. (*Key concepts:* Changes in motion and common forces—speeding up, slowing down, turning, push, pull, friction, gravity. Additional forces—attraction, repulsion, balanced, unbalanced. *Real-world contexts:* Changing the direction—changing the direction of a billiard ball, bus turning a corner; changing the speed—car speeding up, a rolling ball slowing down, magnets, other common objects that are and are not attracted to magnets.)

2. Describe that whenever one object exerts a force on a second object, the second object exerts an equal and opposite force on the first object. (*Key concepts:* Action force, reaction force. *Real-world contexts:* Walking, swimming, jumping, rocket motion.)

3. Describe the forces exerted by magnets, electrically charged objects, and gravity. (*Key concepts:* Electrical charges and magnetic poles—north pole, south pole, positive charge, negative charge, weight, gravitational pull. *Real-world contexts:* Electrically charged or polarized objects, such as balloons rubbed on clothing, bits of paper, salt grains, magnets, magnetic materials, earth's gravitational pull on objects.)

3. Use simple machines to make work easier. (*Key concepts:* Inclined planes, levers, pulleys, gears, wheel and axles, screws, wedges. *Real-world contexts:* Block and tackles, ramps, screwdrivers, can openers.)

4. Design strategies for moving objects by application of forces, including the use of simple machines. (*Key concepts:* Types of simple machines—lever, pulley, screw, inclined plane, wedge, wheel, and axle. *Real-world contexts:* Objects being moved by using simple machines, such as wagons on inclined planes, heavy objects moved by levers, seesaw, cutting with knives or axes.)

3. Analyze the operation of machines in terms of force and motion. (*Key concepts:* Force, motion, and changes of motion—speeding up, slowing down, turning, push, pull, friction, gravity, attraction, repulsion, balanced, unbalanced. *Real-world contexts:* Machines, such as bicycles, automobiles, electrical motors, generators.)

4. Explain energy conversions in moving objects and in simple machines. (*Key concepts:* Types of energy—kinetic energy, potential energy, heat energy. Conversions—see Matter and Energy benchmarks, Efficiency. *Real-world contexts:* Simple and complex machines—see elementary benchmark 3; roller coasters, swings, pendulums.)

Content Standard 4: All students will describe sounds and sound waves; explain shadows, color, and other light phenomena; measure and describe vibrations and waves; and explain how waves and vibrations transfer energy. (Waves and Vibrations)

Elementary	Middle School	High School
1. Describe sounds in terms of their properties (pitch, loudness). (*Key concepts:* Pitch—high, low. Loudness—loud, soft. *Real-world contexts:* Sound from common sources, such as musical instruments, radio, television, animal sounds, thunder, human voices.)	1. Explain how sound travels through different media. (*Key concepts:* Media—solids, liquids, gases. *Real-world contexts:* Sounds traveling through solids, such as glass windows, strings, the earth; sound traveling through liquids, such as dolphin and whale communication; sound traveling through gases, such as human hearing, sonic booms.)	1. Relate characteristics of sounds that we hear to properties of sound waves. (*Key concepts:* Properties of sounds—pitch, volume. Characteristics of sound waves—frequency, amplitude, velocity. *Real-world contexts:* Common sounds that vary in pitch and volume—see elementary benchmark 1.)
2. Explain how sounds are made. (*Key concepts:* Vibrations—fast, slow, large, small. *Real-world contexts:* Sounds from common sources, such as musical instruments, radio, television, animal sounds, thunder, human voices.)	2. Explain how echoes occur and how they are used. (*Key concepts:* Echo, sonar. *Real-world contexts:* Echoes in rooms—acoustics—and outdoors; practical uses of echoes, such as navigation by bats and dolphins, ultrasound imaging, sonar.)	2. Explain how sound recording and reproducing devices work. (*Key concepts:* Parts of sound recording and reproducing devices, including needle, amplifier, speaker, microphone, laser disk reader. *Real-world contexts:* Sound devices, such as record players, tape recorders, medical ultrasound devices, hearing-aids, laser disk players.)
3. Describe light from a light source in terms of its properties. (*Key concepts:* Brightness—bright, dim. Color of light—red, orange, yellow, green, blue, violet. *Real-world contexts:* Light from common sources, such as sun, stars, light bulb, colored lights, firefly, candle, flashlight.)	3. Explain how light helps us to see. (*Key concepts:* Light source, illumination, path of light, reflection, absorption. Parts of eye—retina, vitreous humor, lens, cornea, pupil, iris, optic nerve. *Real-world contexts:* Seeing common objects in our environment; seeing "through" transparent media, such as windows, water.)	3. Relate colors to wavelengths of light. (*Key concepts:* Colors of the spectrum—red, orange, yellow, green, blue, indigo, violet. Properties of light waves: wavelength, amplitude, frequency. *Tools for making spectra:* Prism, diffraction grating. *Real-world contexts:* Spectra made by prisms, diffraction gratings; colored lights, rainbow glasses, rainbows.)
4. Explain how light illuminates objects. (*Key concepts:* Light source, illumination, path of light. *Real-world contexts:* Objects illuminated by light from common sources.)	4. Explain how objects or media reflect, refract, transmit, or absorb light. (*Key concepts:* Reflection, refraction, absorption, transmission, scattering (or diffusion), medium. Transmission of light—transparent, translucent, opaque. Refraction of light—lenses, prisms. *Real-world contexts:* Objects that reflect or absorb light, with and without scattering, such as ordinary light and dark colored metals, mirrors; media that transmit light with and without scattering, such as clear and frosted glass, clear and cloudy water, clear and smoky air; uses of lenses, such as eye, cameras, telescope, microscope, magnifying lens.)	4. Explain how we see colors of objects. (*Key concepts:* Colors of the spectrum and characteristics of light waves—red, orange, yellow, green, blue, indigo, violet, wavelength, amplitude, frequency. Ways that objects interact with light—emission, reflection, absorption, transmission. *Real-world contexts:* Colored light-reflecting objects, such as books, clothes, color photographs; colored light-transmitting objects, such as stained glass, cellophane; colored light-emitting objects, such as television, neon lights.)
5. Explain how shadows are made. (*Key concepts:* Shadow, blocked path. *Real-world contexts:* Shadows made by putting objects in the path of light from common sources, including sunlight, light bulbs, projectors.)		

5. Describe the motion of pendulums or vibrating objects (frequency, amplitude). (*Key concepts:* Period, frequency, amplitude. *Real-world contexts:* Vibrating or oscillating objects, such as pendulums, weights on springs, vocal cords, tuning forks, guitar strings.)

5. Describe different types of waves and their technological applications. (*Key concepts:* Types of waves—mechanical: sound, ultrasound, water waves, shock wave; electromagnetic: radio waves, microwaves, radiant heat, infrared radiation, visible light, ultra-violet radiation, x-rays, gamma rays. Properties of waves—frequency, amplitude, wavelength, wave velocity. *Real-world contexts:* Examples of mechanical waves, such as sound—see above, ocean waves, wave tanks, earthquakes, seismic waves; examples of electromagnetic waves, such as light—see above, radio and television signals, heat lamps, microwave transmitters, ultraviolet radiation in sunlight, X-ray machines, gamma rays from radioactive decay.)

6. Describe waves in terms of their properties (frequency, amplitude, wavelength, wave velocity). (*Key concepts:* Mechanical and electromagnetic waves. Properties of waves—frequency, amplitude, wavelength, wave velocity. Units of measurement—hertz or cycles per second, micrometers, meters, meters per second. *Real-world contexts:* Examples of mechanical and electromagnetic waves—see above.)

7. Describe the behavior of waves when they interact. (*Key concepts:* Super-position, constructive and destructive interference. *Real-world contexts:* Dead spots in auditoriums, spectra made by diffraction gratings, colors observed in soap bubbles.)

8. Relate changes in detected frequency of a source to the motion of the source and/or the detector. (*Key concepts:* Wavelength, frequency, source, detector, motion, shifts in frequency and wavelength. *Real-world contexts:* Engine noise from cars passing by, spectrum of stars, Doppler weather radar, police radar.)

6. Explain how waves transmit energy. (*Key concepts:* Types and forms of energy, longitudinal, transverse, emission, absorption, transmission, reflection. *Real-world contexts:* Reflecting and nonreflecting objects such as mirrors, black cloth, waves in slinkies and long springs, water waves.)

9. Explain how energy is stored and transformed in vibrating and oscillating objects. (*Key concepts:* Kinetic energy, potential energy, total energy. *Real-world contexts:* Examples of vibrating or oscillating objects—see middle school benchmark 5.)

V. Use Scientific Knowledge from the Earth and Space Sciences in Real-World Contexts

Content Standard 1: All students will describe the earth's surface; describe and explain how the earth's features change over time; and analyze effects of technology on the earth's surface and resources. (Geosphere)

Elementary	Middle School	High School
1. Describe major features of the earth's surface. (*Key concepts:* Types of features—rivers, mountains, deserts, plains, valleys, oceans. *Real-world contexts:* Examples of local surface features, such as hills, valleys, rivers; pictures of non-local land features, including mountains, deserts.)	1. Describe and identify surface features using maps. (*Key concepts:* Types of maps—relief, topographic, elevation. Landforms—plains, deserts, plateaus, basin, Great Lakes, rivers, continental divide, mountains, mountain range, or mountain chain. *Real-world contexts:* Maps showing regional surface features, such as the Great Lakes or local topography.)	1. Explain the surface features of the Great Lakes region using Ice Age theory. (*Key concepts:* Great Lakes, ice age. Processes—cold, snow, ice, pressure, moving, melting. Deposits—sand, gravel. Features—moraines. Also see Atmosphere and Weather benchmarks. *Real-world contexts:* Local examples of glacial formations, such as moraines, kettles.)
2. Recognize and describe different types of earth materials. (*Key concepts:* Materials—sand, clay, silt, soil, rock, minerals. Origins—molten rock, river beds, natural vs. manufactured. *Tools:* Hand lens. *Real-world contexts:* Samples of earth materials, such as rocks, sand, soil, ores.)		

3. Explain how rocks and fossils are used to understand the history of the earth. (*Key concepts:* Fossils, extinct animals, dinosaurs, age of fossils, rock layers. Also see Evolution benchmarks. *Real-world contexts:* Fossils found in gravel, mines and quarries, museum displays; local examples of layered rocks.)

4. Describe natural changes in the earth's surface. (*Key concepts:* Causes of changes—volcanoes, earthquakes, erosion, rivers. Results of change—valleys, mountains, cracks. *Real-world contexts:* Places around the school where erosion has occurred, such as gullies formed in down-hill gravel areas, cracks in asphalt.)

2. Explain how rocks and minerals are formed. (*Key concepts:* Processes of forming rocks—melting, cooling, heat, pressure, sediments. Heat source is interior of earth—see Solar System benchmarks. Materials—soil, sand, rock, lava, shells, dead organisms. *Real-world contexts:* Physical environments where rocks are being formed, such as volcanoes—by cooling, ocean floor—by deposition, deltas, beaches, swamps.)

3. Explain how rocks and fossils are used to determine the age and geological history of the earth. (*Key concepts:* Time lines, rock layers, fossils, relative dating. See Waves and Vibrations benchmarks. *Real-world contexts:* Places where rock layers are visible; fossils, such as Petoskey stones.)

4. Explain how rocks are broken down, how soil is formed and how surface features change. (*Key concepts:* Forces—gravity, pressure. Erosion by—glaciers, waves, wind, streams, weathering, plant roots. Decomposition by—bacteria, fungi, worms, rodents, other animals. See Ecosystems benchmarks. *Real-world contexts:* Local areas where erosion by wind, water, or glaciers may have occurred, such as along the shoulder of roads, under downspouts; chemical weathering from road salt, formation of caverns; physical weathering, such as potholes and cracks in sidewalks from frozen water.)

2. Use the plate tectonics theory to explain features of the earth's surface and geological phenomena and describe evidence for the plate tectonics theory. (*Key concepts:* Earth composition—crust, mantle: upper part is slightly molten, mushy; core: interior at high temperature and pressure. See Solar System benchmarks. Forces—tension, compression. Plates—crust, continental, oceanic. Features—faults, trenches, mid-ocean ridges, folded mountains, hot spots, volcanoes. Related actions—earthquakes, seafloor spreading, convection in mantle. See Matter & Energy benchmarks, Waves & Vibrations benchmarks. Evidence of "continental drift"—physical fit of continents, biological similarities, measurements of movement, rock samples. Also see Reflecting on Scientific Knowledge benchmarks. *Real-world contexts:* Recent earthquake and volcanic activities; maps showing the direction of movement of major plates and associated earthquake and volcanic activity.)

5. Describe uses of materials taken from the earth. (*Key concepts:* Transportation—oil into gasoline. Building materials—sand into glass, ores into metals, gravel into concrete and asphalt. Energy—coal burned to produce electricity; uranium for nuclear power. Water—drinking, cleaning, cooling. *Real-world contexts:* Examples of uses of earth materials, such as concrete walls, glass windows, metal chairs.)

5. Explain how technology changes the surface of the earth. (*Key concepts:* Types of human activities—surface mining, construction and urban development, farming, dams, landfills, restoring marsh lands, reclaiming spoiled land. *Real-world contexts:* Local example of surface changes due to human activities listed in the Key concepts above; local examples of negative consequences of these changes, such as groundwater pollution, destruction of habitat and scenic land, reduction of arable land.)

3. Explain how and why earth materials are conserved and recycled. (*Key concepts:* Valuable materials—minerals, metallic ores, iron, copper, aluminum, fuels. Types of resources—renewable, nonrenewable. Conservation, limits, recycling, costs for developing more remote supplies. Recycling processes—melting, shredding, dissolving. Tools: Satellite images and resource atlases. *Real-world contexts:* Local recycling center for materials, such as glass, plastic, aluminum, steel cans, motor oil; examples of technical and social means for slowing and depletion of earth's resources, such as developing more fuel-efficient cars and mandating their use.)

6. Demonstrate means to recycle manufactured materials and a disposition toward recycling. (*Key concepts:* Recyclable materials—paper, metal, glass, plastic. Anti-pollution activities—reduce, reuse, recycle. *Real-world contexts:* Collections of recyclable materials, plans for recycling at home and school.)

Content Standard 2: All students will demonstrate where water is found on earth; describe the characteristics of water and how water moves; and analyze the interaction of human activities with the hydrosphere. (Hydrosphere)

Elementary	**Middle School**	**High School**

1. Describe how water exists on earth in three states. (*Key concepts:* Liquid—visible, flowing, melting, dew, steam. Solid—hard, visible, freezing, ice. Gas—invisible, evaporation, water vapor. Also see Atmosphere and Weather benchmarks. *Real-world contexts:* Examples of water in each state, including dew, rain, snow, ice, steam; examples of melting, freezing, and evaporating. *Real-world contexts:* Examples of water in each state, including dew, rain, snow, ice, steam; examples of melting, freezing, and evaporating.)

1. Describe various forms that water takes on the earth's surface and conditions under which they exist. (*Key concepts:* Liquid water forms—lakes, rivers, oceans, springs. Frozen water forms—continental glacier, valley glacier, snow on mountains, polar cap. Gaseous water in atmosphere. Climate changes, ice ages. Also see Atmosphere and Weather benchmarks. *Real-world contexts:* Local lakes, rivers, streams, ponds, springs; examples of frozen water, including snow, glaciers, icebergs, polar regions, frozen Great Lakes shorelines.)

2. Trace the path that rain water follows after it falls. (*Key concepts:* Precipitation—rain, clouds, fog, run-off. Flow—downhill, to ocean, underground. Bodies of water—streams, rivers, lakes, oceans. *Real-world contexts:* Examples of water flowing locally, including gutters, drains, streams, wetlands.)

2. Describe how rain water in Michigan reaches the oceans. (*Key concepts:* Water path—run-off, creeks, streams, wetlands, rivers, Great Lakes. See elementary benchmark 2 and Atmosphere and Weather benchmarks. Motion of water—currents, waves, tides. Temperature, thermal layering. Ocean composition—saltiness. *Real-world contexts:* Maps showing streams, lakes, rivers, oceans; examples of motions of rivers and lakes; investigations of rivers and lake temperatures.)

1. Explain how water moves below the earth's surface. (*Key concepts:* Ground water—water table, spring, porous, saturate, filtration. Sources—snow melt, rain fall. *Real-world contexts:* Examples of groundwater, including springs, wells, water soaking into the ground.)

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3. Identify sources of drinking water. (*Key concepts:* Water sources—wells, springs, Great Lakes, rivers. *Real-world contexts:* Examples of local sources of drinking water, including wells, rivers, lakes.)

4. Describe uses of water. (*Key concepts:* Domestic uses—drinking, cleaning, food preparation. Public uses—generate electricity, recreation, irrigation, transportation. *Real-world contexts:* Examples of local occasions when water is used, including car wash, swimming pools, fire hydrants, drinking, food preparation, cleaning.)

3. Describe the origins of pollution in the hydrosphere. (*Key concepts:* Sources of pollution—sewage, house-hold dumping, industrial wastes. Limits to natural resources. Also see Geosphere benchmarks and Atmosphere and Weather benchmarks. *Real-world contexts:* Examples of polluted water; examples of occasions when water supply is restricted, such as during droughts.)

2. Explain relationships between the hydrosphere, regional climates, and human activities. (*Key concepts:* Glacier, ice age, ocean currents, convection. Human activities—agriculture, fishing, manufacturing, energy production. Also see Atmosphere and Weather benchmarks. *Real-world contexts:* Global maps showing climates and water circulation patterns; local maps showing lake-effects in Great Lakes region.)

3. Describe how human activities affect the quality of water in the hydrosphere. (*Key concepts:* Quantity of water—rate of use, urbanization. Oceans—oil spills, garbage, ocean life, global warming, marine life. Fresh water—industrial waste disposal, agricultural run-off, herbicides, pesticides, pollution, sewage, acid rain, nutrient levels. Ground water—landfills, leaching, disposal of toxic wastes. Purification technology—filtering, chlorination. Also see Atmosphere and Weather benchmarks. *Real-world contexts:* Examples of local and regional human activities that have measurable effects on water, including farming, industry, sewage disposal, toxic waste disposal.)

Content Standard 3: All students will investigate and describe what makes up weather and how it changes from day to day, from season to season and over long periods of time; explain what causes different kinds of weather; and analyze the relationships between human activities and the atmosphere. (Atmosphere and Weather)

Elementary	Middle School	High School
1. Describe the atmosphere. (*Key concepts:* Air as a substance. Clouds, dew. Also see Hydrosphere benchmarks and Solar System benchmarks. *Real-world contexts:* Daily atmospheric conditions; examples of using air to do work, including balloons, fans.)	1. Describe the composition and characteristics of the atmosphere. (*Key concepts:* Atmosphere—air, molecules, gas, water vapor, humidity, dust particles, air pressure Temperature changes with altitude. Also see Hydrosphere benchmarks. *Real-world contexts:* Examples of characteristics of the atmosphere, including steam, pressurized cabins in airplanes, demonstrations of air pressure; examples of air-borne particulates, such as smoke, dust, pollen, bacteria.)	1. Describe patterns of air movement in the atmosphere and how they affect weather conditions. (*Key concepts:* Gradual movement—air masses, fronts, buoyancy, thermal expansion, convection. Rapid movement—prevailing winds, jet stream. Winds caused by rotation of the earth. Convection—cold air sinks, warm air rises, heat energy from sun. Also see Matter and Energy benchmarks. *Real-world contexts:* Reports of local weather patterns influenced by the jet stream, warm moist Gulf air, cold dry Arctic air.)
2. Describe weather conditions and climates. (*Key concepts:* Temperature—cold, hot, warm, cool. Cloud cover—cloudy, fog, partly cloudy. Precipitation—rain, snow, hail. Wind—breezy, windy, calm. Severe weather—thunderstorms, lightning, tornadoes, high winds, blizzards. Climates—desert (hot and dry), continental (seasonal changes), tropical (hot and humid), polar. *Tools:* Thermometer, wind sock. *Real-world contexts:* Daily changes in weather; examples of severe weather; examples of climates, including desert, mountain, polar, temperate.)	2. Describe patterns of changing weather and how they are measured. (*Key concepts:* Weather patterns—cold front, warm front, air mass. *Tools:* Thermometer, rain gauge, wind direction indicator, weather maps, satellite weather images. *Real-world contexts:* Sudden temperature and cloud formation changes; records, charts, and graphs of weather changes over periods of days.)	
3. Describe seasonal changes in weather. (*Key concepts:* Seasons—fall, winter, spring, summer. *Real-world contexts:* Examples of visible seasonal changes in nature.)		

3. Explain the water cycle and its relationship to weather patterns. (*Key concepts:* Water cycle—evaporation, condensation, cooling, clouds, run-off. Precipitation—rain, snow, hail, fog, humidity, droughts. Also see Changes in Matter benchmarks, Ecosystems benchmarks. *Real-world contexts:* Aspects of the water cycle in weather, including clouds, precipitation, evaporating puddles.)

2. Explain and predict general weather patterns and storms. (*Key concepts:* Weather patterns—cold front, warm front, air mass. Storms—thunderstorms, lightning and thunder, tornadoes, hurricanes, winds. *Tools:* Weather maps, thermometer, hygrometer, anemometer, wind vane, rain gauge, satellite and radar monitoring. Also see Matter and Energy benchmarks and Waves and Vibrations benchmarks. *Real-world contexts:* Observable daily weather patterns; examples of weather reports from TV, radio, newspapers, including representations on weather maps.)

3. Explain changes in climate over long periods of time. (*Key concepts:* Average yearly temperatures. Ice ages, volcanic dust in atmosphere, greenhouse effect. *Real-world contexts:* Histories showing changing climates; predictions of global warming.)

4. Explain appropriate safety precautions during severe weather. (*Key concepts:* Safety precautions—safe locations, sirens, radio broadcasts, severe weather watch and warning. *Real-world contexts:* Examples of local severe weather, including thunderstorms and tornadoes, that change with the seasons; examples of local community safety precautions, including weather bulletins and tornado sirens.)

4. Describe health effects of polluted air. (*Key concepts:* Effects—breathing difficulties, irritated eyes. Sources—car exhaust, industrial emissions. See Reflecting on Scientific Knowledge benchmarks. *Real-world contexts:* Locations and times where air quality is poor; local sources of potential air pollution.)

4. Explain the impact of human activities on the atmosphere and demonstrate means for limiting pollution from households and personal transportation. (*Key concepts:* Air pollution—car exhaust, industrial emissions, smog. Related effects—breathing problems, acid rain, green-house effect and impact of deforestation, ozone depletion. See Reflecting on Scientific Knowledge benchmarks and Geosphere benchmarks. *Real-world contexts:* Examples of human activities that affect the atmosphere, including use of aerosol spray cans, discharge from smoke stacks, car exhaust, burning leaves and wood in stoves and fireplaces; actions, including turning off lights, turning down heat, tuning-up cars, filling tires, driving at a consistent speed, mandating higher fuel efficiencies.)

Content Standard 4: All students will compare and contrast our planet and sun to other planets and star systems; describe and explain how objects in the solar system move; explain scientific theories as to the origin of the solar system; and explain how we learn about the universe. (Solar System, Galaxy and Universe)

Elementary	Middle School	High School
1. Describe the sun, moon and earth. (*Key concepts:* Planet, star, sphere, space, solar system, larger/smaller, closer/farther, heat, light. *Real-world contexts:* Photos and videos from space of the sun, earth, moon, other planets.)	1. Compare the earth to other planets in terms of supporting life. (*Key concepts:* Comparisons—relative distances, relative sizes, atmospheres, heat, temperature of planets. Compositions—rocky, solid, gases, frozen gases. Sun produces the light and heat that falls on each planet. Molecules necessary to support life—see Cells and Living Things benchmarks. *Real-world contexts:* Examples of local and extreme outdoor conditions on earth vs. conditions on other planets; situations where a heat source warms an object at varying distances from it.)	1. Compare our sun to other stars and star systems. (*Key concepts:* Relative temperatures, colors, sizes, similar forces, similar elements, energy, double stars. *Real-world contexts:* Charts, drawings, and accounts of the diversity and similarities of stars throughout the galaxy.)

2. Explain common observations of the day and night sky. (*Key concepts:* Stars, constellations, planets, meteors, friction, comets, Milky Way. Movement of planets relative to stars. *Tools:* Telescopes, binoculars. *Real-world contexts:* Viewing moon, comets, and planets through telescopes and binoculars; meteor showers; Milky Way.) |
| 2. Describe the motions of the earth and moon around the sun. (*Key concepts:* Perceived movement of the sun across the sky, orbit, month, year, day, night, spin, calendar. *Real-world contexts:* Models or diagrams of the positions and relative distances between the sun, earth, moon; models showing the motions of the earth and moon; outdoor observing of the sun's motion.) | 2. Describe, compare, and explain the motions of planets, moons, and comets in the solar system. (*Key concepts:* Orbit, year, spin, axis, gravity, moons, rings, comets. Also see Motion of Objects benchmarks. *Real-world contexts:* Maps showing the motions of the planets, comets, moon and its phases.)

3. Describe and explain common observations of the day and night skies. (*Key concepts:* Perceived and actual movement of the moon across sky, moon phases, stars and constellations, planets, Milky Way, comet tail. *Real-world contexts:* Outdoor observing of the skies, using telescopes and binoculars, as well as "naked-eye" viewing; telescopic and spacecraft-based photos of planets, moons, and comets; news reports of planetary and lunar exploration.) | 3. Describe the position and motion of our solar system in the universe. (*Key concepts:* Galaxies, Milky Way, spiral structure, stars, speed of light, light year, travel times. *Real-world contexts:* Star maps showing constellations and movements of planets; maps, diagrams, paintings, and models of the solar system, showing its motions and its position in the galaxy; fictional accounts of space travel.)

4. Explain why seasons occur on earth. (*Key concepts:* Tilt of the earth on its axis, direct/indirect rays. Also see Atmosphere and Weather benchmarks. *Real-world contexts:* Changes in length of day and height of sun in sky, changes in average daily temperature; globes and diagrams showing earth's tilt and motions of the sun and earth relative to each other.) |

4. Explain current scientific thinking about how the solar system formed. (*Key concepts:* Clouds of gasses and dust, gravity, spinning, heavy and light elements, hot interiors of earth-like planets. Relative ages of the universe and solar system. Tools: Telescopes, binoculars. Also see Geosphere benchmarks. *Real-world contests:* Telescope observing and photos of star-forming regions; drawings and narratives about star explosions and star formation; accounts of searches for other planets around neighboring stars.)

5. Explain how stars form and how they produce energy. (*Key concepts:* Processes of formation—coalescence from clouds of dust and gases, gravity, explosions of stars, heavy and light elements: hydrogen, helium; "big bang." Production of energy—fusion, radiation. Also see Matter and Energy benchmarks and Changes in Matter benchmarks. *Real-world contexts:* Examples of regions of gas and dust in space illuminated by stars; also see middle school benchmark 4.)

6. Explain how technology and scientific inquiry have helped us learn about the universe. (*Key concepts:* information—radiant energy, radio waves, light, spectra, color of stars, moon and meteor samples. Devices—radio, x-ray and optical telescopes, space probes, satellites. Problems for investigation—geology and weather of planets and moons, origins. Also see Waves and Vibrations benchmarks, Reflecting benchmarks. *Real-world contexts:* Histories of discoveries, stories of exploration, visits to observatories and planetariums; videos showing space exploration; samples of space materials, including moon rocks, Mars scrapings, and meteorites.)

Section III:

Planning

PLANNING GUIDE

T*he improvement process is ongoing and unique for each school district in Michigan. It is essential that districts design their continuous school improvement planning process and curriculum around their own particular size, needs, organizational structure, and resources. The following planning model can be used as a guide by districts that want to develop their own customized continuous school improvement process. It focuses on the goal of providing all students with learning opportunities which help them demonstrate rigorous core content standards. The process described in this section is intended to help districts combine the processes they are using for programs such as accreditation and Title I into one continuous school improvement process. The process described in this section is appropriate for aligning instruction and assessment with all content areas. Currently, this section focuses on English language arts, mathematics, science, and social studies. Additional content standards and benchmarks for other core curriculum areas will be incorporated when they are made available.*

Continuous School Improvement

Achieving high student performance through excellence in
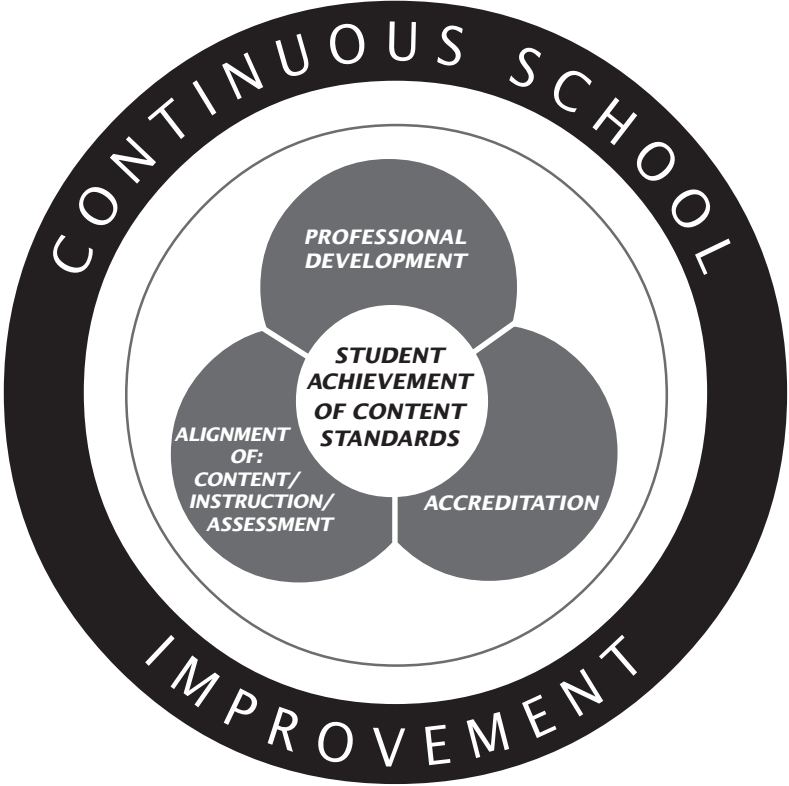
Figure 1

Figure 1 illustrates how the various processes of continuous school improvement interact in order to promote high student performances.
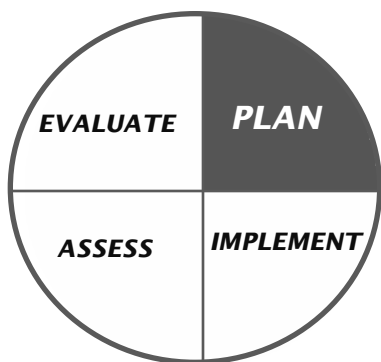
educational programs requires the informed decision-making upon which continuous school improvement is based. Quality school improvement is driven by vision and requires the integration of several ongoing processes: curriculum development, professional development, and accreditation. These processes operate simultaneously as part of the larger system of continuous school improvement and focus on improving student achievement of rigorous core curriculum content standards.

Continuous school improvement is a unifying process that keeps a district focused on its vision of high expectations for all students. It allows a district to coordinate the direction of other important processes and ensures continuity among instructional programs in all the district's buildings. Target goals and strategies that emerge from the school improvement process guide the district's efforts to achieve educational excellence for all students. Target cognitive goals are set by districts as they evaluate the results of student achievement of core curriculum content standards and benchmarks. Strategies are then developed to improve student performance in targeted areas.

Content Standards

A clear identification of K-12 core curriculum content standards and benchmarks is essential to the school improvement process. In collaboration with hundreds of educators from across the state and nation, the Michigan Department of Education has developed curriculum projects for English language arts, mathematics, science, and social studies. The projects provide models of rigorous core curriculum content standards and benchmarks that aid districts as they design curriculum. The standards establish high performance expectations for all students, and the benchmarks further clarify the expectations by explaining what all students must know and be able to do at grade-level clusters. The knowledge and abilities identified in them coupled with student performance data provide direction for establishing clear school improvement target goals.

Although adoption of the standards and benchmarks is voluntary, aligning the district's curriculum with the core curriculum content standards and benchmarks recommended in the framework helps create a curriculum that provides learning opportunities congruent with the knowledge and abilities measured by state assessments.

Instruction

The framework also describes instructional units and programs that illustrate how districts might successfully implement a curriculum based on the content standards and benchmarks. The illustrations take the form of classroom vignettes written by teachers who have been instrumental in the development of the content standards and benchmarks. In the vignettes, teachers describe learning experiences and classroom assessments designed to prepare their students to demonstrate the knowledge and abilities described in the state framework. Aligning instruction with the standards and benchmarks is essential if all students are to achieve high levels of

performance. It is extremely important that content be more than simply covered; it must be learned and applied at the highest levels of thinking.

Assessment

In addition to content standards and instruction, the framework emphasizes the importance of assessment. Assessment should provide ongoing data about learning growth and breadth of content coverage. Districts should design an assessment system that incorporates a variety of assessment tools. Although state assessments are a valuable component of an assessment system, they provide only a small piece of student performance data; therefore, extensive local assessment data is needed to measure student achievement of the core content standards and benchmarks at classroom, building, and district levels. Data should be reviewed regularly to ensure that all students attain high performance expectations, and that no segment of the student population lags behind in achievement.

Alignment

One way to align the district's curriculum with the standards and benchmarks identified in the framework is to conduct a discrepancy analysis. (See toolkit.) Discrepancy analyses help the district align curriculum, instruction, and assessment for the purpose of improving student performance. First the district school improvement team determines the extent to which its current curriculum incorporates the knowledge and abilities identified in the framework's standards and benchmarks. If it does, the district will be assured that its curriculum is aligned with the state-model core curriculum content. Then the district school improvement team analyzes instructional programs to determine if they provide experiences that help all students learn the content identified in their curriculum. This process helps the district achieve alignment between curriculum and instruction. Finally, the district school improvement team analyzes assessment data to ensure that evidence is being collected to determine how well all students demonstrate the knowledge and abilities identified in its curriculum. Analysis of the data helps the district achieve alignment between curriculum and assessment. Aligning curriculum, instruction, and assessment is a major step toward increasing student achievement of core content standards.

Professional Development

Professional development is another key component of school improvement. It is an ongoing process and must be directed toward increased student performance for all students. In order to prepare teachers to participate in the process of aligning curriculum, instruction, and assessment, they must be provided with continuous professional development opportunities which help them learn and apply necessary content and pedagogical knowledge. The framework references state professional development standards and provides subject area examples which serve as guidelines for planning district professional development programs. Implementing the guidelines helps prepare teachers to make informed decisions while aligning curriculum, instruction, and assessment. Implementing the guidelines also helps teachers

Content

Alignment

Assessment
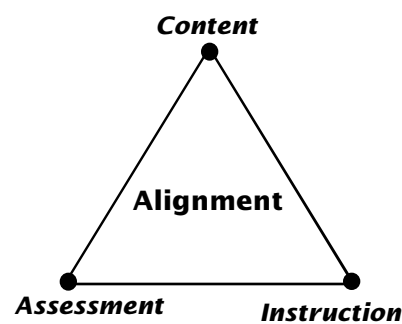
Instruction

provide rich learning opportunities for all students and address multiple intelligences and varied learning styles in their instructional planning.

Accreditation
The final process depicted in Figure 1 is the accreditation process. The state legislature mandates that the accreditation process be a vehicle for evaluating how well districts use the school improvement process and professional development to align curriculum, instruction, and assessment for the goal of increasing student achievement of core curriculum content standards *(The Revised School Code, Section 1280).* Coordinating these processes allows a district to continually move forward in its attempt to provide educational excellence based on high expectations for all students.

Guiding the Curriculum Development Process
Improving curriculum, teaching, learning, and school structure is ultimately the responsibility of the entire education community — teachers, administrators, parents, school board members, students, and interested community members. The goal of this collaboration is to implement quality core content area programs based on rigorous standards and a concern for equity for all learners.

Figure 2

Sample Planning Model to Establish District Curriculum Alignment

Identify District and Building Committees

Develop and/or Align Visions of District, Buildings, Departments

Conduct A Discrepancy Analysis With the K-12 Michigan Core Curriculum Content Standards and Benchmarks
(Identify gaps in current program in order to align with the state.)

Establish District/Building Standards and Benchmarks
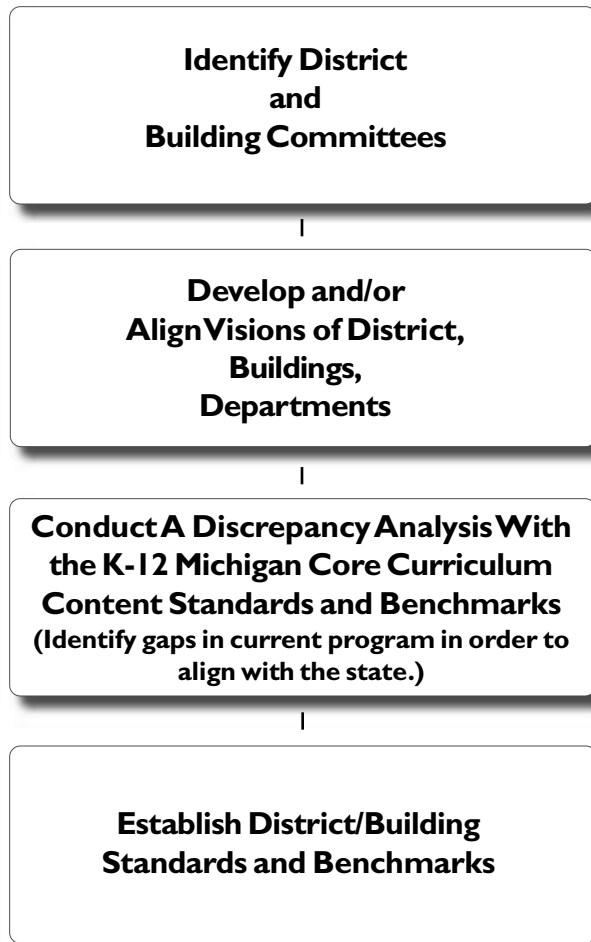
Figure 2 depicts the steps in designing a curriculum based on the core curriculum content standards.

ORGANIZING FOR CURRICULUM DEVELOPMENT AT THE DISTRICT LEVEL

District School Improvement Committee

One of the first steps in coordinating the processes of continuous school improvement is to create a district school improvement committee. Committee members might include representatives from core content area committees, administrators, parents, and interested community members.

The first task of the school improvement committee is to review the district's vision statement, mission statement, and goals before beginning the task of coordinating curriculum development efforts. The committee will want to make sure that the vision statement and goals address the adult roles or competencies for which students are being prepared. The vision statement and goals should also incorporate the teaching and learning principles discussed in this framework. Higher-order thinking skills, deep knowledge, substantive conversation, and connections to the world beyond the classroom are key issues in the development and implementation of a curriculum based on rigorous standards.

Important Curriculum Considerations

In addition, the vision should include language which ensures that interdisciplinary connections, connecting with the learner, instructional technology, and workplace connections become essential considerations in the district's core content area curriculum development. (See toolkits.) Creating an effective context for learning necessitates considering these four additional areas of instruction. These areas are related to the Teaching and Learning Standards and are crucial to the context of authentic learning (see section IV, "Teaching and Learning"). They are integrated throughout the content standards and benchmarks presented in the *Michigan Curriculum Framework*.

Interdisciplinary Connections:
Real problems often require knowledge from more than one discipline to generate effective solutions. Within the subject areas as within the content standards and benchmarks, there are many natural overlaps. As teachers design courses of study and standards-based units of instruction, they will begin to dissolve the artificial boundaries that sometimes separate content areas.

Connecting with the Learner:
Instruction based on high expectations for all students is needed to result in improved learning for all students. Teachers can connect with the learner by providing examples of instructional approaches which show an understanding of learning styles in diverse classrooms. Another way is to integrate assessment and instructional activities which give students a chance to show what they know, rather than what they don't know. Building confidence and interest through examples and role models showing the contributions of diverse groups also helps connect the learner to what is being taught. Finally, teachers can connect with the learner by involving parents as active partners and participants in the educational process of their children.

The District School Improvement Team should answer the following questions . . .

- What should students know and be able to do?

- Are assessments measuring what students are expected to know?

- What training is needed to provide alignment among content, instruction, and assessment?

- Are parents and students included on the committees?

- Do the content area visions align with the district vision?

- Has the district conducted discrepancy analyses? (See toolkit.)

- Do learning experiences align with what the curriculum says students need to know and do?

- What are the district's school improvement goals?

Instructional Technology: Learning with and about technology prepares learners to live responsibly in a democratic, technologically driven society. Students can use technology for knowledge acquisition, communication and information management, problem solving, creative expression, research, and design. Learners become technologically capable when they apply technology across discipline areas and when technology is used across the content areas.

School-to-work Connections: One of the adult life roles for which students prepare is that of a productive worker. Education prepares students for successful entry into the world of work and/or continuing education in order to pursue their career goals. Educators in the core curriculum areas in collaboration with counselors, career and technical educators, post secondary educators, and other specialists may contribute to this process by offering instruction in career exploration, employability skills, applied learning, and integrated academic and career curriculum, and by coordinating with secondary and post secondary occupational preparation programs.

Another important responsibility of the school improvement committee is to establish a consistent format for core content area standards and benchmarks. The committee can help ensure that the standards and benchmarks are written at the same level of generality so that teachers can more easily see similarities among the various content areas. The committee will also want to review the standards, benchmarks, instructional programs, and assessment plans presented by the core curriculum content committees to ensure that they are aligned and provide the curricular foundation needed to increase student performance.

Finally, the district school improvement steering committee will want to create a plan for monitoring the effectiveness of the district's content area programs. The plan should formulate an assessment system which includes evidence of performance at several levels: state, district, building, classroom, and individual students. The assessment system should include the results of state assessments as well as other appropriate local criterion-referenced assessments. It should also incorporate data from performance tasks designed by content area committees and individual classroom teachers.

Core Curriculum Content Area Committees
Once the district school improvement committee is in place and has completed its initial tasks, core content area committees should be established in English language arts, mathematics, science, and social studies, in addition to other content areas for which standards and benchmarks are available. These committees should include participants who represent every school and grade level. Administrators, parents, and community members may also be represented. The role of the committees is to design plans for developing,

aligning, implementing, assessing, and monitoring the effectiveness of content area curricula. Members of the committees will use their specialized content area expertise to make sure that the district develops and implements quality programs.

Creating Content Area Visions

A shared vision must align district, building, and classroom efforts to develop and implement comprehensive content area curricula. Each content area has key issues that need to be considered as curricula are developed. Some of the issues relate to content and some reflect important pedagogical concerns. For example, traditionally, language arts programs have been divided into separate curriculum components based on reading, writing, speaking, and listening objectives. The *English language arts* standards and benchmarks are created from research that demonstrates that literacy is developed through the integration of the language arts processes and content. The *mathematics* standards and benchmarks describe content relevant to a technology and information based society. Mathematical literacy is a product of understanding content, procedural proficiency, and problem solving ability. Michigan's vision is that all students be mathematically literate. *Science* education standards and benchmarks are based on a vision of useful and relevant scientific understanding. Science literacy means that students can use their understanding of science in real-world contexts; their understanding does not remain simply theoretical and abstract. The s*ocial studies* standards and benchmarks are based on the premise that to develop social understanding and civic efficacy, the social studies curriculum builds four capacities in young people: disciplinary knowledge, thinking skills, commitment to democratic values, and citizen participation. Each capacity contributes uniquely to responsible citizenship.

The core content area committees will want to begin their task by creating district English language arts, mathematics, science, and social studies vision statements and literacy goals. The core content area projects provide extensive reading lists to help committee members review literature describing the best practice and research in the field of English language arts, mathematics, science, and social studies. Committee members might read and discuss several articles with the purpose of identifying and forming consensus on the learnings and experiences that students need to possess in order to progress continuously toward higher levels of literacy in the core content areas. The committees can use this information to generate vision statements that capture the district's principles and beliefs about what constitutes core curriculum content area literacy. Visions should focus on student learning and emphasize quality achievement. They should be reviewed by the district steering committee to ensure that they are aligned with the district's vision statement and goals for educational excellence.

Creating Content Area Curricula

District core content area committees might begin by synthesizing resources that will help them develop or revise core content area curricula and facilitate achievement of the district's

core content area vision statements and goals. Identifying core content standards is essential, and the process should begin with an in-depth study of the *Michigan Curriculum Framework*. Although some districts may choose to adopt the "Michigan Content Standards and Benchmarks" as they are presented in this document, others may choose to adapt them to further reflect the needs of their student population and community. Some districts may investigate and explore other resources that discuss important issues related to the teaching and learning of English language arts, mathematics, science, and social studies. They may consider other resources such as exemplary national curriculum projects, research on teaching and learning in the core curriculum content areas, research on child and adolescent development, and input from key groups in the community before identifying standards for their English language arts, mathematics, science, and social studies curricula.

Benchmarks must be identified to describe the knowledge and behavior needed to demonstrate each standard. The benchmarks should be inclusive of what students need to know and be able to do in order to achieve the standards at cluster levels, such as early elementary, later elementary, middle school, and high school. The model benchmarks provided in this guidebook will be helpful in completing this task. The committee should analyze the benchmarks to ascertain if they are developmentally appropriate for cluster levels and to ensure that they establish higher levels of content knowledge demonstration as they progress across cluster levels. The committee will want to revise the benchmarks to reflect the needs of their students and their community.

The committee will want to also analyze the district's instructional program to determine how well learning experiences align with the standards and benchmarks. In mathematics and science, programs can be evaluated and selected on the basis of how effectively they provide instruction that prepares students to demonstrate the standards and benchmarks identified in the framework. In English language arts and social studies plans will need to be developed for helping teachers design their own units of instruction. These plans should clearly identify the standards and benchmarks which are being addressed. The plans should also identify instructional resources and how they should be used.

Monitoring Core Curriculum Content Programs
District core content area committees should design plans for monitoring the effectiveness of the district's English language arts, mathematics, science, and social studies programs. The plans should formulate an assessment system which includes evidence of performance at the district, building, and individual student level. In addition to using data from state assessments, the core content area committees select or design performance tasks (assessment activities) which measure demonstration of standards and benchmarks not easily measured on large-scale assessments. These tasks can

EVALUATE   PLAN

ASSESS   IMPLEMENT
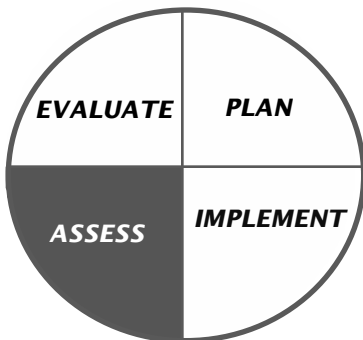
be analyzed at grade-cluster levels to assess student growth and curriculum coverage. By sampling evidence obtained in performance tasks, districts can evaluate building progress in school improvement efforts related to the English language arts, mathematics, science, and social studies curricula.

AT THE BUILDING LEVEL

Strengthening The Vision

A building level commitment must be made to the visions of English language arts, mathematics, science, and social studies curricula described in the district's core content standards and benchmarks. A similar process to the one followed for the district level might be followed at the building level. Teachers may want to read articles and books which reflect best practice and research in the fields of English language arts, mathematics, science, and social studies. This review will help create a foundation upon which to build the curriculum and instruction needed to achieve district standards and benchmarks. It is essential that teachers share the beliefs on which their standards and benchmarks are based.

Teachers will want to use their reading to clarify and support the key issues inherent in the district's English language arts, mathematics, science, and social studies vision statements. They will want to review the vision statements in terms of their buildings' student population and parental concerns. If necessary, the vision statements might be revised to reflect the unique characteristics of the building's educational community.

Refining The Curriculum

Building level staff will want to review the district's core content standards and benchmarks. Grade level teams should analyze the benchmarks to determine learning experiences which are needed for students in a particular grade level to develop the enabling skills and knowledge required to demonstrate acceptable performance levels of the standards.

Grade level teams or course instructors will want to analyze resources available for instruction in relationship to the learning experiences they have identified for each grade level or course. A plan should be developed for obtaining resources that are not available. A summary of learning experiences and content knowledge topics will need to be prepared and shared with the rest of the staff.

The staff will want to discuss the depth and breadth of coverage for each benchmark. It must be clear that experiences are being provided that guide students' acquisition of progressively more complex knowledge and skill. As they proceed from one grade level to the next, an analysis should be completed to show that each benchmark is addressed within the grade level span identified for each cluster level. Some schools may choose to use a matrix to trace which benchmarks are addressed at each grade level or course. *(See mathematics example on page 11 of "Planning.")*

The summary of experiences, learnings, and resources chosen for each grade level or course should be analyzed in relation to
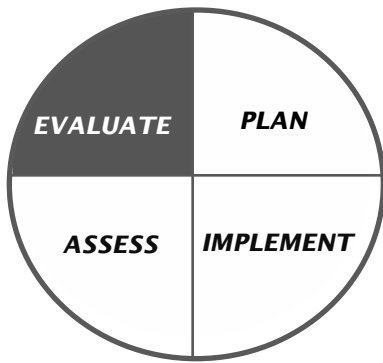
how well they prepare students to perform the tasks identified as evidence for achievement of cluster-level benchmarks. The summaries should be revised to reflect the processes and content measured by the performance tasks. The summaries of experiences, learnings, and resources included in each grade level or course should be reviewed regularly to incorporate changing trends in student needs and assessment results.

Evaluating The Building Program

A building assessment plan will need to be developed to gather information about learning results. From assessment data buildings can evaluate the effectiveness of the English language arts, mathematics, science, and social studies programs. An analysis should be completed on how well students perform on state assessments. When the data is analyzed, it can be used to set building school improvement goals in English language arts, mathematics, science, and social studies. Where appropriate, strategies will need to be developed to increase student achievement levels.

In addition to state assessment data, a local assessment plan may consider data gathered from performance tasks designed to assess how well students demonstrate the knowledge and abilities in the standards and benchmarks. Performance tasks for each grade level or course can be identified or developed using the district's assessment system guidelines and performance descriptions presented in the *Michigan Curriculum Framework*. Where appropriate, scoring guides can be created evaluating student performance on tasks, and a system for recording and reporting results can be designed. Data should be analyzed to ascertain how well students are achieving the standards and benchmarks and how thoroughly the standards and benchmarks are being taught by building teachers.

Some performance tasks should map onto state assessments and serve as interim evaluations of student growth in areas measured by the Michigan Educational Assessment Program (MEAP) and High School Proficiency Test (HSPT). Other tasks should reflect demonstrations of important core content benchmarks which cannot be easily measured by large-scale assessments. They should be part of an assessment system which includes opportunities for students to maintain portfolios or logs describing their work, participate in public exhibitions of their learning, demonstrate comprehensive knowledge of English language arts, mathematics, science, and social studies processes and content, and set learning goals and reflect upon their growth.

The evidence gathered in the building assessment system should be reviewed and evaluated by building staff and used to refine school improvement goals. The evidence should be weighed against clearly established performance standards. District core content area committees also will want to review representative samples of student achievement to determine if students are demonstrating literacy levels described in the district's performance standards.

EVALUATE PLAN

ASSESS IMPLEMENT

Sample Mathematics Standards/Benchmark Matrix

I. Patterns, Relationships, and Functions

1	Patterns	1	2	3	4	5	
2	Variability & Change	1	2	3	4	5	6

II. Geometry and Measurement

1	Shape & Shape Relationships	1	2	3	4	5	6	7
2	Position	1	2	3	4	5	
3	Measurement	1	2	3	4	5	6

III. Data Analysis and Statistics

1	Collect, Organize, & Present Data	1	2	3	4
2	Description & Interpretation	1	2	3	4	5
3	Inference & Prediction	1	2	3	4	5

IV. Number Sense and Numeration

1	Concepts & properties of Numbers	1	2	3	4
2	Representation & Uses of Numbers	1	2	3	4	5
3	Number Relationships	1	2	3	4	5

V. Numerical and Algebraic Operations and Analytic Thinking

1	Operations & Their Properties	1	2	3	4
2	Algebraic & Analytic Thinking	1	2	3	4	5

VI. Probability and Discrete Mathematics

1	Probability	1	2	3	4	5	
2	Discrete Mathematics	1	2	3	4	5	6

This type of matrix can be used by teachers or groups of teachers as they analyze the content standards and benchmarks addressed in instructional units or chapters.

AT THE CLASSROOM LEVEL ━━━━━

Creating A Personal Vision

Each classroom teacher will want to explore articles and books which describe best practice and research for the purpose of creating or refining a personal vision of the core academic content areas. Using state, district, and building vision statements and goals as resources, teachers should reflect upon the key issues and principles which guide their instructional decision-making. They should write their own personal vision statements and establish goals for their teaching. These should be placed where they can be easily retrieved to reflect upon and share with parents and staff members at appropriate times.

## Implementing The Curriculum

Once teachers have gathered and reflected upon evidence of student demonstration of the core content benchmarks, they are ready to construct a classroom curriculum. Most teachers find it helpful to start with a unit that they are currently using and have found to be successful. The unit could be one selected from an existing program or one created by the classroom teacher. In either case, it should provide students with multiple experiences that help them gain depth and breadth of knowledge while applying increasingly complex levels of the core curriculum content knowledge and processes.

Teachers should review the unit to analyze how many of the benchmarks are addressed and to what extent they are demonstrated. Then teachers can look for ways to extend the unit to include opportunities for students to learn and demonstrate the processes and knowledge contained in other benchmarks. The unit should include a variety of activities that help students refine processes and deepen their understanding of core content. The unit should provide ample scaffolding, but it should also challenge students to explore *complex text* and *concepts in new contexts*. The text and activities emphasized in the unit should always be designed to strengthen knowledge and improve abilities.

Successful units can be shared with other grade level or course teachers. The vignettes included in the core content area guidebooks provide samples of units constructed by teachers at various cluster levels. They can be used to guide teachers as they develop their own units.

Using Assessment To Guide Instruction

Teachers should assemble evidence of student achievement in their grade level class or course. The evidence should be analyzed to identify which core content area learnings and knowledge are being measured. Teachers will want to identify where these learnings and knowledge are addressed in the appropriate cluster-level benchmarks. Using a highlighter or colored marker to identify the learnings and knowledge that are being assessed will help paint an overview of which English language arts, mathematics, science, and social studies processes and knowledge are valued in the teachers' classroom
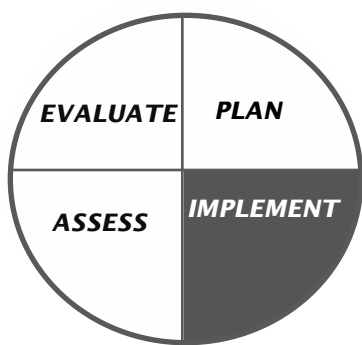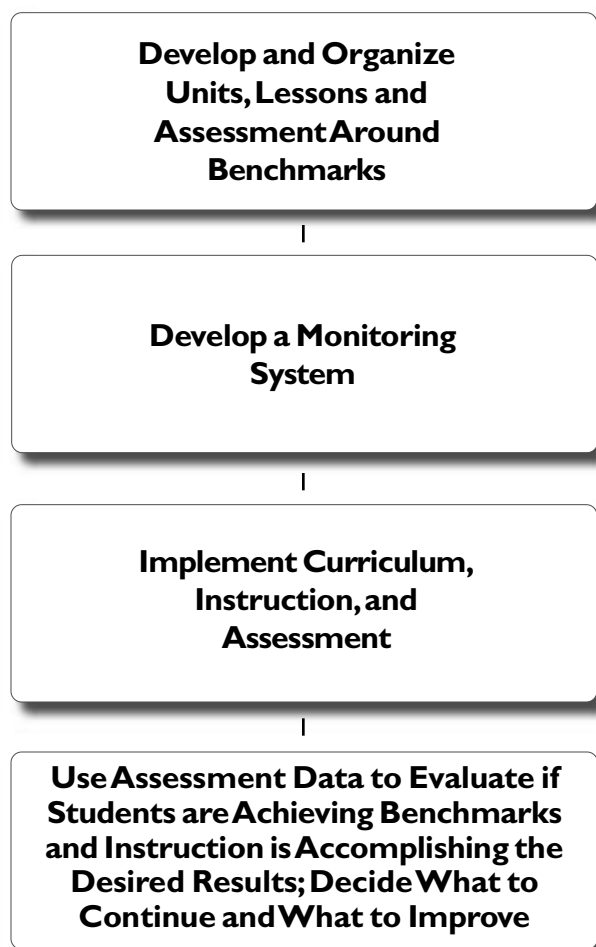
instruction. It will also clearly identify what is not being given sufficient emphasis.

Using this information will help teachers begin to prepare thoughtful samples of evidence to support the building's assessment systems. Teachers will want to select performance tasks which are natural extensions of current instructional units. The tasks should prompt students to demonstrate application of knowledge in activities which synthesize core curriculum content knowledge.

Some performance tasks should be designed to give evidence of student progress in core content area benchmarks which are measured on state assessments. Some should be designed to give evidence of student achievement of benchmarks which cannot be measured by large-scale assessments. Classroom performance tasks can include group activities as well as individual activities. They should represent authentic application of core curriculum content area knowledge and

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│   Develop and Organize   │
│    Units, Lessons and    │
│    Assessment Around     │
│       Benchmarks         │
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┌──────────────────────────┐
│   Develop a Monitoring   │
│          System          │
└──────────────────────────┘
             │
┌──────────────────────────┐
│   Implement Curriculum,  │
│     Instruction, and     │
│        Assessment        │
└──────────────────────────┘
             │
┌──────────────────────────┐
│ Use Assessment Data to Evaluate if │
│ Students are Achieving Benchmarks  │
│ and Instruction is Accomplishing the │
│   Desired Results; Decide What to  │
│   Continue and What to Improve     │
└──────────────────────────┘
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Figure 3

Sample Content Area Planning Model for Buildings and Departments

Figure 3 depicts the steps needed to monitor the success of a district's attempt to align curriculum, instruction, and assessment.

processes. The tasks should be varied in format so that they provide for multiple learning styles.

Performance standards for the core content strands and benchmarks will need to be consulted as teachers prepare tasks. Once students have completed a task, scoring guides are created to measure student attainment of performance standards at the strand or benchmark level.

Teachers will need to develop a system for recording student performance and reporting to parents and other teachers. Their system should be consistent with the reporting system created by the building and district.

Conclusion

The line between curriculum, instruction, and assessment becomes very blurred in today's classrooms because good instruction is created out of the interactions between assessment and curriculum. To create an effective program, districts must provide continuous professional development opportunities for their staffs, and they must ensure that there will be an ongoing dialogue between teachers, parents, and interested community members about what students *should* know and *do* know. Beginning with a strong curriculum and professional development program, a district can use the continuous school improvement process to assess needs, set target goals, design strategies, and evaluate the success of its core curriculum content area programs.

Section IV:

Teaching & Learning

TEACHING AND LEARNING

The purpose of this section is to illustrate what standards-based teaching and learning looks like in today's classrooms. Five vignettes representing experiences in early elementary, later elementary, middle school, and high school classrooms are featured in this section. They reflect teaching and learning based on content standards and benchmarks in social studies, English language arts, mathematics, science, and interdisciplinary study. The vignettes provide examples of Michigan teachers who are making decisions about how to incorporate the content standards and benchmarks into their instructional planning. They are designed to help educators begin a discussion about standards-based teaching and learning. The vignettes do not advocate a single best practice or method of instruction. They are not prescriptions of what must be done; they are examples of what can be done when teachers reflect on how to align curriculum, instruction, and assessment in order to promote meaningful student understanding of the content standards and benchmarks.

As an introduction to the vignettes, this section describes four standards which form the foundation of authentic teaching and learning. These standards are: higher-order thinking, deep knowledge, substantive conversation, and connections beyond the classroom. Effective implementation of the Standards for Teaching and Learning assumes that the classroom context is predicated on the belief that all students can and will learn. In order to be successful, instruction must not only incorporate the standards listed above, but it must also take place within an environment that provides sufficient social support to permit all students to learn no matter what their gender, ethnicity, socio-economic status, disability, English language proficiency, or preferred learning style. An atmosphere of positive social support occurs when the teacher conveys high expectations for all students and encourages students to take learning risks and try hard to master challenging academic work. The type of social support needed exists when the teacher's attitude and actions affirm the belief that all members of the class can learn important knowledge and skills. Positive social support requires creating a climate of mutual respect among all members of the class so that students with less proficiency are treated in ways that encourage their efforts and value their contributions. For more information about creating positive social support for learning and about selecting strategies that motivate all students to learn see the *Connecting with the Learner Toolkit*. (See "Appendix A.")

> *"In the long-term, education must aim for active use of knowledge and skill. Students gain knowledge and skills in schools so they can put them to work in professional roles—scientist, engineer, designer, doctor, business person, writer, artist, musician—and in lay roles—citizen, voter, parent—that require appreciation, understanding, and judgment."*
>
> David Perkins
> Harvard University

Standards of Authentic Instruction

Authentic instruction is meaningful instruction. It helps learners move beyond memorization by creating learning experiences which demand sustained, disciplined, and critical thought on topics that have relevance to life beyond school. Research shows that when teachers and students engage in authentic instruction and learning, student achievement increases. Fred M. Newmann, Walter G. Secada, and Gary G. Wehlage at the Wisconsin Center for Educational Research have synthesized much of the research that relates to student achievement in *A Guide to Authentic Instruction and Assessment: Vision, Standards, and Scoring.* They tell us that students are most successful when they use and apply the knowledge they are learning and the abilities they are developing to solve real-world problems and conduct relevant investigations. The four standards of authentic instruction described by Newmann, Secada, and Wehlage are integral to the content standards and benchmarks. Each helps form a foundation from which increased learning and understanding stems. They provide a structure for instructional design in English language arts, mathematics, science, and social studies. These standards are:

- ◆ **Higher-Order Thinking:** Instruction involves students in manipulating information and ideas by synthesizing, generalizing, explaining or arriving at conclusions that produce new meaning and understandings for them.

- ◆ **Deep Knowledge:** Instruction addresses central ideas of a topic or discipline with enough thoroughness to explore connections and relationships and to produce relatively complex understanding.

- ◆ **Substantive Conversation:** Students engage in extended conversational exchanges with the teacher and/or peers about subject matter in a way that builds an improved and shared understanding of ideas or topics.

- ◆ **Connections to the World Beyond the Classroom:** Students make connections between substantive knowledge and either public problems or personal experiences.

Considering these standards helps individual teachers and instructional teams ensure that they are providing students with authentic learning opportunities. Incorporating the standards into instructional decisions helps create effective experiences for learning the knowledge and abilities described in the content standards and benchmarks. The standards of authentic instruction are embedded in the content standards and benchmarks. They help teachers enhance student learning by providing them with instructional opportunities that move them past a superficial understanding to an in-depth application of the knowledge and skills they are learning.

Making Instructional Decisions

The "Michigan Content Standards and Benchmarks" form a sound basis from which to build a strong curriculum. However, a strong curriculum is only one step. After districts answer the question, "*What must our students know and be able to do?*" they must ask themselves, "*What kind of instruction will enable students to demonstrate the knowledge and abilities defined in their curriculum?*"

The standards of authentic instruction and the topics listed as important considerations are important guidelines for developing sound instructional programs. (See Section III, pages 5-6 for further explanation.) The vignettes presented in this section are useful tools for beginning a discussion about authentic teaching and learning. One way that the vignettes can be used is to have a group of teachers read them and then reflect on how the teachers and programs described in the vignettes address the standards of authentic instruction, as well as the important considerations for effective instruction. As teachers study the vignettes they will form learning communities that will support those who are seeking to align their instructional programs with the knowledge and abilities defined in their district's standards and benchmarks.

The first vignette is written for an early elementary classroom studying social studies. The second is written for a later elementary focusing on English language arts. The third is written for a middle school classroom engaged in interdisciplinary study. The fourth is written for a high school mathematics class, and the fifth is written for a high school science class.

The vignettes can be used to facilitate professional development. In one instance teachers might be asked to read and reflect on one of the vignettes. In another instance teachers might be divided into five groups and asked to read and reflect on one of the vignettes. The vignettes could be distributed among the groups so that each group reads a different vignette. Then the various groups could be asked to share responses with the whole group.

After teachers have finished discussing one or all of the vignettes, they might be asked to reflect upon their own practice. They should think about an important unit taught in their course, and then consider the questions listed on page 4. Teachers should be given enough time to discuss their units in relation to how they address the standards and benchmarks and how they address the principles of authentic instruction. They might be asked to discuss ways they incorporate technology and interdisciplinary instruction into their teaching. They might be asked to discuss how they make connections with the learner and how they make school-to-work connections. The questions presented on page 4 provide an example of the types of questions that might be discussed. These questions should be modified to reflect the curriculum goals of the district.

The following questions may facilitate group discussion:

I. How do the teachers create opportunities for students to learn and demonstrate the knowledge and abilities identified in the content standards and benchmarks?

- How does the teacher organize instruction so as to help students learn the knowledge and abilities described in the content standards and benchmarks?

- Are there any content standards and benchmarks addressed in the vignette that have not been identified?

- Which areas of the vignette might be expanded to incorporate content standards and benchmarks from other disciplines?

II. How do the teachers integrate the standards for teaching and learning into instructional activities?

- How does the teacher or program create opportunities for students to engage in higher-order thinking about the standards and benchmarks?

- What strategies does the teacher or program employ so as to ensure that students are processing knowledge and skills at a deep level of understanding?

- How does the teacher or program engage students in conversations that require them to discuss topics at a conceptual level?

- How does the teacher or program help students connect the knowledge and skills they are learning to the world beyond the classroom?

- How does the teacher or program use an understanding of learning styles to create diverse instructional approaches?

III. How does the teacher incorporate standards-based assessment into instruction?

- How does the teacher or program integrate assessment with instructional activities?

- How does the teacher align assessment with the standards and benchmarks?

- How does the teacher focus performance tasks on high expectations for student performance.

IV. How does the teacher integrate into instruction important instructional considerations such as interdisciplinary connections, technology, and school-to-work connections with the learner?

- Where and how does the teacher or program create opportunities for students to make interdisciplinary connections?

- How does the teacher or program ensure that students are making connections to important knowledge and skills incorporated within a content area?

- How does the teacher or program incorporate opportunities for students to acquire, organize, analyze, and present information using technology?

- Where and how does the teacher or program help students develop skill in the use of technology?

- How does the teacher or program help students recognize and refine skills and knowledge used in the workplace?

- How does the teacher help students explore career connections or implications for the knowledge and abilities learned during the unit?

Purpose of Vignettes

The vignettes included in this section are designed to illustrate how teachers might incorporate the Standards for Teaching and Learning (higher-order thinking, deep knowledge, substantive conversation, and connections to the world beyond the classroom) into their teaching units. The vignettes also illustrate how teachers might design instructional experiences which help students develop the knowledge and abilities identified in the standards and benchmarks. The Standards for Teaching and Learning and content standards and benchmarks being addressed in the unit are identified in the side-bar.

Marcia Harris teaches kindergarten at the Brookside School in Bloomfield Hills, Michigan. Brookside is a private school and part of the Cranbrook Schools. Cranbrook Schools service approximately 1,550 students in 6 programs: 1 early childhood, 1 elementary, 2 middle schools, and 1 high school. There are 223 faculty members on the Cranbrook staff. Kindergarten at Brookside is a half-day program. Time spent on social studies instruction each day ranges from 30 to 40 minutes. Ms. Harris shares the responsibilities for teaching 20 four- and five-year olds with teachers, Virginia Walden and Katie Fiebig.

The unit, **Where Do I Live?**, was designed by Ms. Harris and Ms. Walden. The unit is 31 lessons which integrate geography with language arts, social studies, mathematics, reading, and art. **Where Do I Live?** includes activities that develop map reading skills related to finding locations, interpreting symbols, and determining direction. The geography skills are developed within the context of the geographic themes of location, place, movement, and region. Each objective taught is developmentally appropriate and follows the model of involving students first in an enactive experience, then an iconic one and finally a symbolic activity.

The unit focuses on seven key objectives which include:

- ❖ understanding that an address includes a number and street name;
- ❖ understanding that a map is drawn from an aerial perspective;
- ❖ understanding that a symbol is a representation of a real object;
- ❖ understanding that a city includes places where people work, live, and shop;
- ❖ developing the ability to calculate distance;
- ❖ developing the ability to formulate a constructive response to a social problem in their neighborhood; and,
- ❖ recognizing that money is used to buy groceries and services.

The culminating social studies activity revolved around formulating constructive responses to a series of social problems in their neighborhood. Ms. Harris believes that this added an important social studies dimension to the unit.

Developing Perspective
Where Do I Live? begins with the enactive experience of observing a familiar piece of climbing equipment on the playground—the climbing dome. On the playground the students talk about the shape of the dome with Ms. Harris, offer descriptions, and draw the shape of the dome in the air using their arms. The students are developing the concept of a profile perspective.

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Back in the classroom students have the opportunity to view a photograph of the dome and talk about the dome's shape in much the same way they did on the playground. Several students volunteer to draw the dome on large sheets of paper. Each student then draws the dome from a profile perspective on smaller sheets of paper. Drawing the profile of the climbing dome translates the enactive experience into an iconic one. The unit continues on day three as Ms. Harris changes the perspective from which the students see the climbing dome. The students climb to the top of the school tower. From this point, they can see the playground and the climbing dome. Ms. Harris describes this perspective to the students as a bird's-eye view. In the classroom, using a photograph of what the students saw from the tower, the students describe the aerial perspective. Similarities and differences between the two perspectives are noted. The students draw the climbing dome again, this time from an aerial perspective. Drawing the dome from an aerial perspective is difficult for students initially. The students' drawings are displayed on a bulletin board. Each aerial perspective is matched with the profile perspective from the previous day.

Higher-Order Thinking:
Students produced new meaning and understanding after arriving at conclusions.

To further develop the concept of aerial perspective, students observed a variety of objects in the classroom from both a profile and aerial perspective. In a variety of activities over the next few days, the students have the opportunity to view objects from both a profile perspective and an aerial perspective. The aerial perspective is possible by using climbing equipment in the classroom. Photographs of familiar objects are taken using both perspectives. The photographs become the basis of a sorting activity in which students separate the photographs into stacks. One stack of photographs contains objects shown in profile; the other stack containing the photographs of the same objects shown from an aerial perspective.

Connection to the World Beyond the Classroom: Students make connections between substantive knowledge and personal experience.

Deep Knowledge:
Students have gained and demonstrated connections and relationships to a complex understanding.

Making Maps
Having firmly established the concept of aerial perspective, Ms. Harris moves to the making of maps. Maps, of course, use an aerial perspective. The focus question is "What is a map?" Students begin by sharing what they know about maps. The most common knowledge held by the students is that road maps are used to help drivers get to different locations.

SOC.II.3.EL.1 Identify locations of significance in their immediate environment.

Students begin with making a map of their discussion circle. A large laminated paper oval is placed on the floor to represent the circle. *Fisher Price Play People* are used to represent each of the students. The teachers prepare the *Play People* by affixing a photocopied picture of each student's face to a *Play People* figure. The students then make a map of the discussion circle, placing their classmates on the paper oval in the correct location. Ms. Harris then moves the students and the students adjust the map accordingly.

In groups of five, the students recreate the map activity using photocopied pictures of each of their group members and pasting them onto paper circles. After finishing their maps, the group recreates the map for the entire class by forming their

group in the same manner indicated on the map. This activity links the enactive, concrete experience to the iconic experience of making a picture map. The next day the students use symbols to represent classroom objects to make a map of the classroom.

What Is An Address?

The focus of the lessons changes from the school to actual neighborhoods and cities in the next group of lessons. The first focus question is, "What does an address tell us?" The concept of an address containing two pieces of information is a complex one for four- and five-year olds. Students are given an address on either Cardinal or Bluebird Street in a pretend neighborhood created in the classroom. The floor is marked with colored tape to represent the two streets. Chairs are lined up to represent the houses. Each student moves into their house one at a time. Students have an opportunity to visit each other using their addresses to locate the person they will visit. Pizza and flower deliveries are made to the students with the teachers acting as the delivery persons utilizing addresses.

The next lessons require the students to use milk carton houses to recreate the neighborhood using the colored tape on the classroom floor as the streets. The "chair houses" are removed and students place their milk carton house on their assigned street at the right address. The next lesson transfers the floor map to paper. The students make a map of their classroom neighborhood.

The students are given envelopes with a milk carton house address on it. They are then asked to use the map of the school neighborhood to deliver mail to the correct student.

Using Taxes For The Neighborhood

What happens in a neighborhood? How do we use money? What can the government do? These were the focus questions of the enactive experience that followed the neighborhood map. Stores were set up and each student was given $5 to spend. Before the students could spend their "play money," however, they had to give $1 to the government as a tax. Ms. Harris reflects that the students really did not know what this meant. The students had a chance to use their remaining money to buy goods and services.

One child was selected to have a "fire" at home. The answer to the dilemma of "What should we do?" was discussed by the students briefly and it was agreed that calling the fire department made the most sense. "Who will pay the firefighters?" was raised by several students. The unanimous conclusion was that the government should pay them using the money collected as taxes. The concept of some people working for everyone and being paid by the government through the use of taxes was explored and reinforced.

Symbolic Experiences

Utilizing lists of addresses, students matched their classroom addresses with photocopied pictures of the members of the

class. In their journals they recorded the addresses of students they remembered and their own address. Students were given cards with their real addresses on them. Ms. Harris lead the students in a discussion of the meaning of the numbers and letters. The students were given the assignment of drawing their real homes and putting the appropriate address on the picture with number stickers.

Working With Maps And Distance

Ms. Harris showed aerial photographs and a road map of the same area to the students. The students discussed the similarities and differences. Tracing paper was placed over the aerial photograph and the students traced over the roads and streets to create a road map from the photograph.

On the school grounds using the school as a base point, Ms. Harris led the students in a comparison of distances of various objects. The concept of near and far was explored. Ms. Harris led the students on a walk to experience the distance of one mile. The students walked 1/2 mile away from the school and then returned. Upon their return Ms. Harris led them in a discussion of the experience.

Using symbols for people and the school, the students estimated and then measured the distance between the school and some *Play People.* To further integrate mathematics into the unit, parents were asked to record the mileage between home and school. To prepare for the social studies activity, Ms. Harris placed pieces of tape with the student's name and photocopied picture on the rug. These pieces of tape designated the child's approximate distance from the school. Each student took a turn putting his/her *Play Person* on the name tape. A lively discussion followed during which the students were able to identify who lived near them, why it made sense that several of them were in a car pool together, and who lived the farthest from the school.

SOC.II.3.EL.1 Identify locations of significance in their immediate environment.

At the next circle time the students were given pieces of paper with their mileage from school recorded. Using linking cubes to symbolize the miles, the students made stacks to represent how many miles it was from their home to school. A distance graph was made using the photocopied pictures of the students and the linking cubes laid horizontally next to their picture. The graph was transferred to paper the next day. The unit of measure was one mile equals one linking cube.

Social Problems

The students have two opportunities in this unit to solve a community problem. In the first case Ms. Harris plays a messy neighbor, Sloppy Sally. It is explained to the students that Sloppy Sally has old cars and junk all over her yard. The mess is an eyesore and all the neighbors are unhappy. What will the community do? Students are divided into groups of five to discuss their ideas. The solutions are brought to Sloppy Sally one by one in an effort to solve the problem.

Substantive Conversation: Students engage in extended conversational exchanges.

SOC.VI.3.EL.1 Compose brief statements expressing a decision on an issue in the school or local community.

Connections to the World Beyond the Classroom.

SOC.II.1.EL.1 Describe the human characteristics of places and explain some basic cause for those characteristics.

SOC.II.3.EL.1 Identify locations of significance in their immediate environment and explain reasons for their location.

The second problem deals with the location of a new park. The park is something that all the people in the community would like to have located in their neighborhood. Each group gets a chance to make a proposal. The proposals are then debated and a decision is made by the class.

What's In A City?
Students brainstorm a list of places they would expect to find in a city. Ms. Harris records the places for the class. The students visit a nearby city. On the bus tour Ms. Harris had the students identify the things they actually saw in the city. A new list was generated to later compare to their brainstormed list. Visits were made to the bank, post office and police station. Upon their return the students used unit blocks to recreate the city they visited.

The culminating activity involved each child drawing a picture and sending it through the mail to themselves. This activity was both enactive and symbolic. Envelopes were addressed by the students, their pictures were enclosed, and the class then walked to the mailbox to mail their letters, definitively answering the question **Where Do I Live?**

Student evaluation took place throughout the 31 day unit. Assessment included evaluation of drawings, maps, sorting activities, and group work.

The evaluations reflected objectives set in advance by Ms. Harris with an emphasis on the student's ability to analyze, apply, and demonstrate an understanding of disciplinary concepts.

Resources
The following trade books were read to the students throughout the unit. Each of the books reinforces one or more of the objectives.

Brown, Laurence and Marc, *Visiting the Art Museum*
Burton, Virginia Lee, *Katie and the Big Storm, The Little House, Mike Mulligan and the Steam Shovel*
Douglas, Florian, *The City*
Gag, Wanda, *Nothing At All*
Gibbons, Gail, *The Post Office Book, Mail and How it Moves*
Keats, Ezra Jack, *A Letter to Amy*
McMillan, Bruce, *Mouse Views*
Provensen, Alice, *Farm and Country*
Pryor, Bonnie, *The House On Maple Street*
Rockwell, Anne, *Gypsy Girl's Best Shoes*
Stevens, Janet, *The Farm Mouse and the Country Mouse*
Wildsmith, Brian, *What the Moon Saw*
Wood, Audrey, *The Napping House*

Elizabeth Smith teaches third grade at Grayson Elementary School in Waterford. The Waterford School District is located in a northern suburb of Oakland County. The school district serves over 11,000 students in 21 schools: 15 elementary, 3 middle schools, 2 high schools, and an early education center.

Approximately 1,500 students qualify for free or reduced lunch, and more than 640 receive special education services. Over 620 teachers are employed, and their average seniority is almost 20 years.

Third graders in Ms. Smith's class learn first-hand about the responsibilities of good citizenship during a two-month-long thematic unit. They examine and apply criteria for responsible change in their own Waterford community through the study of a variety of class and contemporary texts, oral history, interviews, and field trips. A thematic statement and focus questions guide the study of community change.

The unit focuses on:

- ◆ generating and investigating important questions regarding community change;

- ◆ drawing key ideas from text to formulate generalizations and principles;

- ◆ applying key ideas and principles derived from multiple texts to establish a criteria for evaluating community change;

- ◆ selecting, recording, and organizing relevant information obtained during investigation for the purpose of drawing conclusions and presenting findings; and,

- ◆ using writing and speaking skills to effectively present conclusions.

The unit culminates in a presentation in which students describe and evaluate the benefits of the community change they have investigated and make recommendations for future change. They present their findings in front of an audience of their peers, district staff members, community members, and parents.

Ms. Smith, a veteran teacher, has been teaching a unit on Waterford for many years and decides to "remodel" it by broadening the topic to include the broader concept of community change. She also wants to experiment with incorporating the English language arts content standards and benchmarks into her curriculum design. What began as an experiment in remodeling has turned into a powerful learning experience for both Ms. Smith and her students.

Connections to the World Beyond the Classroom: The teacher considers what she knows about her students and what is likely to interest them. She selects a topic for study that is rooted in their experiences.

ELA.3.LE.1 Integrate listening, speaking, viewing, reading, and writing skills for multiple purposes and in varied contexts.

ELA.10.LE.1 Identify how their own experiences influence their understanding of key ideas in literature and other texts.

SOC.II.4.LE.1 Draw sketch maps of the community, region, and nation.

ELA.3.LE.5 Employ multiple strategies to construct meaning while reading, listening to, viewing or creating text.

ELA.3.LE.8 Express their responses to visual, written, and electronic texts, and compare their responses to those of others.

Substantive Conversation: The teacher engages students in a discussion which builds a shared understanding about the topic.

ELA.10.LE.2 Combine skills to reveal their strengthening communication arts literacy.

ELA.8.LE.2 Identify and use elements of various narrative genre and story elements to convey ideas and perspectives.

ELA.3.LE.3 Read and write fluently, speak confidently, listen and interact appropriately in situations, view knowledge, and represent creatively.

SOC.I.1.LE.2 Place major events in the development of their local community and the State of Michigan in chronological order.

ELA.11.LE.2 Identify the kinds of resources that are most useful and most readily available for the particular questions or topics they wish to investigate.

Deep Knowledge: The teacher encourages students to write frequently in their journals as a way of reflecting on their prior knowledge, contemplating new ideas, formulating opinions, and constructing new knowledge.

Eight year olds' lives are centered around nearby communities—homes, schools, and neighborhoods. Ms. Smith uses these familiar contexts as places to conduct initial data collections about change. The students take a neighborhood walk where they identify and record changes observed. They record or sketch the changes on a map provided and describe changes based on data they gather from parents and neighbors. They notice such things as new homes, tree removal, streets that have been paved, and new neighbors.

Back in the classroom, Ms. Smith facilitates as students, first in small groups and later in the total group, share their collected data and list the changes (on an organizer). She asks them to consider who might see the changes as positive and why, and who might see the changes as negative and why. After all observations and ideas have been shared, Ms. Smith asks her students to write in their journals conclusions they can draw about community changes and the effects they have on people who live and work there. After individually writing their responses, a classroom discussion provides students with an opportunity to hear each others' ideas.

To further develop the concept of community change over time, Ms. Smith has her students carefully review the book *Window* by Jeannie Baker and describe the changes they observe. Then they draw a window scene of their own depicting what their community might have looked like 100 years ago. Students use the writing process to develop a narrative text elaborating on their predictions. Classroom walls become a museum where students exhibit their drawings. They read their predictive narratives to one another as well.

Next, the president of the Waterford Historical Society is invited to visit the class. She brings along slides, photographs, maps, and other artifacts which pictorially show the Waterford community as it was 100 years ago. She posts them around the room, and students compare the real photos and artifacts to their predictions as shown in their drawings and writings. Once again they return to their journals and write their conclusions drawn about community changes and the effects they have had on people who live and work there.

Students now insert push pins on a map of Waterford to determine the locations of the 100-year-old places depicted in the photographs, and a field trip is planned to return to the original sites and collect data about how they look today. Armed with video cameras, sketch pads, journals, and cameras, the students set out for the investigation. When they return to the classroom, evidence of the sites as they look today is displayed alongside the 100-year-old photos and artifacts. Students are asked to identify what has changed and who might perceive the changes as positive and why, and who might perceive the changes as negative and why. Finally, students speculate in their journals about what determines if a change is positive or negative and share their speculations with one another in a whole class discussion.

By now the students are "hooked" on the theme and are ready to move into a more formal study. Ms. Smith reads *A River Ran*

Wild by Lynne Cherry and does a think-aloud in response to the focus questions:

- ◆ What determines if a community change is positive or negative?

- ◆ Does the environment exist to be used by humans?

- ◆ Do people have a responsibility to care for and protect the natural environment?

- ◆ Can special interests be reconciled for the common good?

Higher-Order Thinking: The teacher provides rigorous focus questions for the thematic study. She models strategies for recording, organizing, and analyzing information about the community.

She also uses a matrix and invites the class to join in a shared writing completing the matrix and using information from the text.

Change	Fast/ Slow	Reversible/ Irreversible	Natural/ Man-made	Beneficial/ Harmful and Why?

MAT.I.1.EL.2 Represent and record patterns and relationships in a variety of ways including tables, charts, and pictures.

When it appears that students have gained a degree of comfort with the process, Ms. Smith does a book talk on a variety of other trade books depicting community change from a range of perspectives, cultures, time periods, and genre (e.g., *My Place* by Nadie Wheatley and Donna Rawlins, *The Great Kapok Tree* by Lynne Cherry, *Just A Dream* by Chris Van Allsburg, *Rain Forest* by Helen Cowcher, *Brother Eagle, Sister Sky* by Susan Jeffers). Children select several books and work in small groups to read the literature and respond to the focus questions, first in their individual journals and then together in a shared discussion. The small groups work together to add additional information to the matrix.

ELA.3.LE.6 Determine the meaning of unfamiliar words and concepts in oral, written, and visual texts by using a variety of resources, such as prior knowledge, context, glossaries, and electronic sources.

ELA.7.LE.1 Use a combination of strategies when encountering unfamiliar texts while constructing meaning.

ELA.5.LE.4 Describe how various cultures and our common heritage are represented in literature and other texts.

In order to complete the activity, the total class comes together to debrief the changes identified in various pieces of literature. They begin a discussion of the responsibilities people have to the community and to the natural environment.

ELA.9.LE.1 Explore and reflect on universal themes and substantive issues from oral, visual, and written texts.

ELA.8.LE.3 Identify and use characteristics of various informational genre and elements of expository text structure to convey ideas.

Deep Knowledge: The teacher enables students to achieve complex understanding by assigning readings that provide multiple perspectives on the issue.

Individually, students read a district social studies text, *Water Wonderland; A History of Waterford*. Periodically they pause in order to discuss examples of significant changes and record them on the ever-expanding matrix. They appear to be easily

able to think about the community in terms of changes, instead of (as in the past) specifically about facts related to Waterford. It is exciting for Ms. Smith to see that she had been able to create experiences and enable her students to develop their understanding of broader connections.

Ms. Smith continues to push for depth of understanding and pairs her students with senior citizens who share their personal knowledge of changes in Waterford. The oral histories provide the young students access to primary resources and allow them to practice interviewing as a method for collecting data. Again they return to their journals to reflect on the focus questions and use the matrix to record additional changes.

SOC.I.3.LE.1 Use primary sources to reconstruct past events in their local community.

ELA.10.LE.3 Use oral, written, and visual texts to research how individuals have had an impact on people in their community and their nation.

Teacher and students identify and invite experts from the community (e.g., DNR, Township Planning Commission, a land developer, a builder, a member of the Oakland County Road Commission) who might serve as resources on Waterford change. The children determine who might be the most authoritative sources and write letters inviting them to become panel members.

ELA.11.LE.3 Organize and analyze information to draw conclusions and implications based on their investigation of an issue or problem.

ELA.3.LE.4 Distinguish between verbal and nonverbal communication, and identify and practice elements of effective listening and speaking.

Deep Knowledge: The teacher encourages students to continuously uncover new information and evaluate it in light of their developing hypotheses.

When the panel is formed, students interview them to get their responses to the focus questions and their thoughts about criteria for responsible community change, as well as descriptions of past and projected future changes in Waterford. The students do a mature job of interacting with the experts. After the interview, students do a journal write, and add data to their matrix and add to their criteria for responsible community change. Thank-you letters are written and sent to both the panel and senior citizens.

As a check for understanding the students construct a Venn diagram comparing changes in the Waterford community with those in one of the trade books they read. They then develop a compare/contrast paper using the writing process. Their piece may take on the form of any of the genre they have been studying: poetry, picture book, essay, song, etc. Once again they refine their growing list of criteria for responsible community change.

ELA.7.LE.4 Develop and use a variety of strategies for planning, drafting, revising, and editing several different forms of texts for specific purposes.

ELA.8.LE.1 Identify and use writing mechanics that enhance and clarify understanding.

ELA.9.LE.2 Draw parallels and contrasts among key ideas, concepts, and varied perspectives found in multiple texts.

Now Ms. Smith reviews the following requirements for the final performance demonstration and explains that the criteria they have been developing for responsible change will be an important component.

Performance Demonstration

As a group of community planning consultants, you will: collaboratively design a presentation that demonstrates your ability to access, process, organize, and interpret information regarding changes that have occurred in the Waterford community. Further, you will make recommendations for the future of your selected topic and describe how your recommendations fit the criteria for responsible community change. You will take a position on the thematic statement: **People have a responsibility to consider the rights of others when making community changes.** Your audience will be adults interested in your work (parents, member of

ELA.9.LE.3 Use conclusions based on their understanding of differing views presented in text to support a position.

MAT.III.1.EL.2 Organize data using concrete objects, pictures, tallies, tables, charts, diagrams, and graphs.

planning committee, etc.). Your work must be focused on one of the following choices:

- Business/Industry
- Transportation/Roadways
- Public Service—fire, police,
  library, sanitation, medical emergency, etc.
- Buildings/Homes
- Schools
- Teacher-Approved Choice

Include the following:

- A description of the change
- Cause(s) of the change
- Effect(s) of the change and those impacted
- Who would see the changes as positive and why?
- Who would see the changes as negative and why?
- A plan you would recommend that would be good for most of the members of the Waterford Community using the criteria for responsible community change.

Individually, do a one-page reflection which describes your growth in understanding of issues relating to community change. Be ready to discuss your growth using your journal as evidence.

Specifically: Your presentation should be no longer than 10 minutes. All members of your group must take part. You must select at least one of the following ways to show what you have learned:

- video
- game
- skit
- overhead
- teacher-approved choice

- photographs
- charts/graph
- drawings
- music/dance

You must be prepared to share the data you have collected and show the process you have used to get to the final presentation.

Ms. Smith wants to let students know how the presentations will be evaluated so she designs the scoring guide that will be used to evaluate their presentations. First, Ms. Smith identifies the standards that can be most directly assessed during the presentations. She identifies the following standards:

Depth of Understanding (Standard 9) — All students will demonstrate understanding of the complexity of enduring issues and recurring problems by making connections and generating themes within and across texts.

Ideas in Action (Standard 10) — All students will apply knowledge, ideas, and issues drawn from texts to their lives and the lives of others.

Inquiry and Research (Standard 11) — All students will define and investigate important issues and problems using a variety of resources, including technology, to explore and create texts.

ELA.6.LE.4 Reveal personal voice by explaining growth in learning and accomplishment through their selection of materials for different purposes and audiences.

ELA.7.LE.2 Monitor their progress while using a variety of strategies to overcome difficulties when constructing and conveying meaning.

ELA.8.LE.5 Describe and use the characteristics of various oral, visual, and written texts, and the textual aids they employ to convey meaning.

SOC.I.2.LE.2 Use narratives and graphic data to compare the past of their local community, the state of Michigan and other parts of the U.S. with present-day life in those places.

Then Ms. Smith reviews the benchmarks identified under each standard for later elementary students. She uses this information to review the unit to make sure that it includes learning opportunities that will help students successfully demonstrate the standards assessed in the culminating task. She consults the performance description charts for reading, writing, speaking, listening, and viewing to select criteria upon which to base her scoring guide. The performance description charts synthesize the knowledge and abilities included in the benchmarks for each English language arts communication mode. They help teachers identify proficient demonstration of the standards for their student-appropriate grade level cluster. Ms. Smith selects the following descriptions of proficiency because they directly relate to knowledge and ability she wants to assess at the end of her unit.

All students will:

- ◆ apply key ideas and themes derived from multiple texts that represent a balance of perspectives to formulate personal views on persisting issues and problems;

- ◆ use speaking and writing as tools for taking responsible action related to important issues, ideas, and problems in their school and community;

- ◆ use an increasingly wide variety of text forms, conventions, and elements of the writer's craft, and both verbal and nonverbal elements of the speaker's craft to achieve a purpose for a specified audience;

- ◆ investigate important questions, problems, or issues and use the most appropriate resources to generate supported answers and/or conclusions; and,

- ◆ select, record, and organize relevant information from a variety of resources to determine answers and draw conclusions in response to important questions, problems, and issues.

Ms. Smith uses the information in the performance descriptions to design her unit's culminating demonstration task. She wants the task to be an integrated assessment of her students' achievement of the English language arts standards so she combines some of the performance indicators such as those for reading, viewing, and listening and those for speaking and writing. Once Ms. Smith identifies what a proficient demonstration of the standards and benchmarks will look like, by using the performance descriptions, she is ready to design a tentative scoring guide.

First, she creates a description of what she expects students to do if they reach the goals of the performance demonstration described in the performance descriptions for the later elementary grade level cluster; she labels this a 3. Then she refines that description to identify what it might look like if students exceed grade level cluster expectations. She consults the middle school performance descriptions as she writes a description for another level of performance which she labels 4. She consults the lower elementary performance descriptions as

she writes what the demonstration for the later elementary grade level cluster will look like, and she also writes one for students whose presentation does not demonstrate the criteria identified for the performance task.

Scoring Guide:

4 Presents an accurate, compelling rationale for community change which includes an analysis of past, present, and future change. Communicates information and insights in a manner which engages the audience. Creatively uses visual and other supporting materials which enhance the key ideas or issues. Collects, analyzes, evaluates, and organizes data to produce polished written and oral text.

3 Presents a clear description of community change, supported by factual information which demonstrates the student's understanding of the reasons for change and their consequences and their recommendations for the future. Presents information clearly and effectively for their audience. Uses visual and other supporting materials which clarify key ideas or issues. Collects, analyzes, synthesizes, and organizes data to produce written and oral text.

2 Presents a description of community change, supported by some factual information which demonstrates the student's understanding of change and some recommendations for the future. Loosely organizes information with little attention to audience. Uses visuals without connections to key ideas or issues. Collects and attempts to organize data to produce written and/or oral text.

1 Presents a description of community change with little or no support that demonstrates the student's understanding of change or recommendation for the future. Shows little or no evidence of organization or consideration for audience. Uses none or few visuals. The visuals fail to make connections to key ideas or issues. Collection of evidence is scant or nonexistent.

She shares the scoring guide with her students so that they will know what is expected for quality performance. She knows that she will need to revise the scoring guide after assessing the presentations. Once she compares what students are expected to do with what they actually accomplish, she will be able to refine the scoring guide so that it more clearly identifies the characteristics of a quality performance.

At this point a great deal of information has been collected, analyzed, and processed, and students are mindful of the culminating performance required at the end of the unit. Ms. Smith decides it is time for students to do a more formal response to the focus question, giving specific reasons for their answers. In order to practice the skill of applying criteria for responsible change in new contexts, the students engage in a role play. They are divided into three groups, and each

Connections to the World Beyond The Classroom: The teacher helps students to understand various perspectives on the issue through the role play in which they act as local individuals, members of a planning commission, and citizens attending a town meeting.

group is given a scenario for a proposed change in their community (50 new lake front homes will be built, a new strip mall will be built in the lot next to the school, a theme park is proposed at the site of the old high school, etc.).

One group plays out the various roles of those who have a particular/vested interest in the proposed change and who reside in the area of the proposed change. Each group member is given a role related to the change (builder, homeowner, wildlife advocate, etc.).

ELA.4.LE.1 Describe language patterns used in spoken, written, and visual contexts within their own environment.

ELA.6.EL.2 Experiment with the various voices they use when they speak and write for different purposes and audiences.

ELA.7.LE.3 Apply new learning by forming questions and setting learning goals that will aid in self-regulation and reflection on their developing literacy.

They role-play how the proposed change will affect them and how they feel about the change. As the role-play goes on, another group serves as a planning commission responsible for deciding whether or not to approve the change, and the final group serves as the audience at a town meeting. This group determines the degree to which the planning commission applies the criteria for responsible community change. The groups rotate until all students have had an opportunity to participate in the role-play, serve on the planning commission, and be a member of the town hall audience.

ELA.11.LE.3 Organize and analyze information to draw conclusions and implications based on their investigation of an issue or problem.

In preparation for the culminating performance demonstration, the students conduct a collaborative inquiry. They select a topic, identify appropriate resources, collect, analyze, and organize data. Using criteria as a means for determining "responsible" community change requires them to consider various perspectives before making evaluations and drawing conclusions.

At last it is time to plan and rehearse the presentation. Ms. Smith and her students decide on the audience—parents, other teachers, and a variety of community members. The stakes are high. The students tailor their presentation to meet their audiences' needs. What types of examples will they employ? What arguments and support will be important and persuasive in considering their recommended community change? Which medium and mode of presentation will make the greatest impact? Ms. Smith asks many questions as students consider possibilities and test options. The desire to do a quality job on this performance is evident. Motivation, engagement, and excitement run high.

ELA.11.LE.4 Using multiple media, develop and present a short presentation to communicate conclusions based on the investigation of an issue or problem.

MAT.III.3.EL.3 Formulate and communicate arguments and conclusions based on data and evaluate their arguments and those of others.

ELA.8.LE.4 Identify and use aspects of the craft of the speaker, writer, and illustrator to formulate and express their ideas artistically.

The big day arrives and performances are conducted. Students are serious, impeccably dressed and groomed. Parents arrive and sit proudly by as the young community planning consultants present their compelling arguments. Papers describing personal growth are well documented using journal entries as evidence of growth. The children are articulate in describing the inquiry process. They comfortably use language that enables Ms. Smith to clearly see that the process of inquiry, as well as the concept of responsible community change are understood.

ELA.12.LE.1 Develop individual standards for qualities of effective communication for different purposes, and compare them to their own oral, written, and visual texts.

Ms. Smith carefully evaluates each performance. She analyzes how well students meet the criteria of both the content and processes demonstrated in the presentations. She provides the students with feedback by meeting with them in their small groups and showing them the strengths and weaknesses of

their presentations. She uses elements of their presentation and journals to illustrate her comments. Students discuss their presentations and set future learning goals, both individually and as a group.

"This is more, much better than I ever anticipated," says Ms. Smith. "I have just raised my expectations for third graders!"

Ms. Smith decides that one of the most important aspects of this unit is the culminating project. It provides her with a clear picture of what students know and are able to do. She's pleased that the process she used allows her to integrate both content and process in English language arts. She recognizes the potential this performance task has for engaging students in authentic inquiry that allows them to explore their own world.

ELA.4.LE.5 Recognize and use language appropriate for varied contexts and purposes.

Connections to the World Beyond the Classroom: The authentic project requires multiple activities that are intellectually engaging; a performance that has a real audience of parents and community members; and the application of learning to the real world.

This vignette is a composite of real experiences in several classrooms. Names are fictitious, but the classroom is representative of those found in middle-sized high schools that have diverse populations.

In this unit, students are working with a unit developed by Michigan teachers based on content standards and benchmarks and designed to illustrate the goals for scientific literacy (see Section II, "Michigan Content Standards and Benchmarks," science vision statement). The unit is part of the *New Directions* series and is used by teachers across the state in classes that range from general science to high school biology to adult education. Many regional Mathematics and Science Centers provide workshops on this and other *New Directions* units.

The unit focuses on:

- ◆ explaining how selected systems and processes work together in plants and animals;

- ◆ explaining how cells use food as a source of energy;

- ◆ explaining the process of food storage and food use in organisms; and,

- ◆ explaining how multicellular organisms grow based on how cells grow and produce.

Ninth graders in Ms. Lapham's general science class are studying a unit called *Food, Energy and Growth*. Last week they collected data on various foods by testing them in the chemistry lab to identify carbohydrates, proteins, and fats. The unit began with these chemical tests and would end several weeks later by having students design nutritious meals based on what they knew about the components of various foods.

SCI.I.1.HS.3 Students investigate the natural world as an integral part of science learning. Investigations give them opportunities to use their powers of observation, their abilities to reason and solve problems, and to use tools that are appropriate to the inquiry.

Early in the unit, the students read in their text, "The three major components in food are carbohydrates (which include sugar and starch), fats and proteins." Then Ms. Lapham asked the class, "Where have you heard of these before?"

"I've seen those on cereal boxes," offered Katrina.

"We talked about fats in health class," said Arnold. "The book said that too much fat is bad for you."

Ms. Lapham asked, "Does anyone know why fat is not good in large amounts?"

"I think it has something to do with your heart," suggested Marie.

Deep Knowledge: The teacher checks students' prior knowledge, to design instruction based on what students know and that addresses their naive understandings.

"Naw," Reggie countered. "They just tell you that about anything that tastes good."

Ms. Lapham found that her students didn't know that

SCI.I.1.HS.1 Students freely ask
questions as they pursue
understanding.

carbohydrates, proteins, and fats are what actually make up food (along with fiber); they didn't know what carbohydrates and proteins are used for in our bodies. This information about her students' prior knowledge agreed with the results of research conducted by the unit developers and helped to guide her as she planned her lessons and interacted with students in class.

When they first began their food tests, they did not have a strong sense of how to conduct these types of experiments. Ms. Lapham modelled the procedure and discussed with students the rationale behind it. She guided them in group interaction, making suggestions to facilitate group success.

Craig was ready with a question when Ms. Lapham got to table 4. "Why do we have to test water? It doesn't have any food in it."

"Craig, that's a good question. Let's see if anyone else was puzzled by that part of the procedure." Ms. Lapham walked to the front of the room and wrote "Time Out" on the chalkboard. After about 20 seconds, the room quieted and the students turned toward Ms. Lapham.

*Substantive Conversation: Whole
class discussion and debate is as
typical as small group work; students
listen to and respond to each other.*

"Craig asked an important question about the food tests. I wonder if anyone else has the same question." She looked at Craig. "Please say your question again, Craig."

Craig repeated his question and the room erupted with assenting comments. "That's really stupid, Ms. Lapham," agreed Teresa. "Why should we test something that's not even food?"

Ms. Lapham turned to the whole class. "Did anyone notice a change in the indicator when it was mixed with water?"

"I did," volunteered Freya.

"What did you see?" asked Ms. Lapham.

"The iodine solution changed from dark orange to light yellow."

"So what did we learn by testing water with iodine?"

Joel raised his hand. "We learned that the iodine will get lighter when you add water, but that's not the change you're looking for."

"That's right, Joel," agreed Ms. Lapham. "When you tested other foods did you see any tubes that showed the same color change as the water?"

Tomas raised his hand.

"Yes, Tomas?" encouraged Ms. Lapham.

"Test tube #5, with the cooking oil in it changed to light yellow, too," he described.

"What does that mean?" queried Ms. Lapham.

Mark's hand shot up. "I've got it!" he cried. "There isn't any of the nutrient we're testing for in the cooking oil."

"You're right," smiled Ms. Lapham. "The test tube with water in it shows us what the solution looks like when there is no reaction. Does anyone know what scientists call that part of the setup?"

"That's the 'control,' isn't it?" offered Bonnie.

"Yes," replied Ms. Lapham. "It's an important part of experiment design."

"I get it, now," exclaimed Craig. "Without the water to compare to, we wouldn't know that the cooking oil change didn't really mean anything."

"Right, Craig," agreed Ms. Lapham. "Who can tell me which nutrient iodine tests for?"

"Is it starch?" queried Kayli.

"Well," coached Ms. Lapham. "What makes you say starch?"

Kayli said. "Test tube #2, the one with the corn starch solution, was the only one that changed to a different color. So, I think iodine reacts with starch."

"Which groups got the same result?" asked Ms. Lapham of the class. Several students raised their hands.

Ms. Lapham called on Al, who did not have his hand raised. "What result did you get?"

"I don't know," Al replied. Then he complained, "All the tubes changed color. I don't know how to tell which is the one to look at."

Ms. Lapham explained about the "control" in test tube #1, and how to use that as a comparison.

"Oh, okay," said Al. "I see now. Test tube #2 is definitely different."

"Continue your tests, now," directed Ms. Lapham. "You have about ten more minutes until clean up time. I'll give you the signal."

Later, as Ms. Lapham passed table 7, she spoke to Al. "Why do you think we're testing foods that are light colored?"

"I don't know," intoned Al. Then he thought for a moment. "The iodine is pretty dark, so I guess it might be hard to see the color change in a Coke."

"Exactly," laughed Ms. Lapham.

During the second food test, Ms. Lapham answered questions about the procedure and corrected problems as they occurred. She gave the students additional suggestions about group interactions.

Initially, students were resistant to working in small groups. The third day of the unit, the whole class ground to a halt.

Ms. Lapham got the class' attention. "I think we're having a problem functioning effectively in groups. These are real problems. These food tests are a lot easier to complete when everyone does part of the work. Let's make sure each person has a role and knows what to do. If you don't remember what the roles are, check the overhead. If your group can't figure out how to do the tasks from your book, raise your hands and I'll come help you."

Several hands went up at table 2. Ms. Lapham sat down with the students.

"Ms. Lapham, these results are confusing," said Carla.

Deep Knowledge: The teacher checks students' developing understanding often, keeping notes of students' progress both for coaching and for conferences with parents.

Substantive Conversation: Group work is the norm. Students of both genders and all ethnicities share key roles in groups.

materials are essential questions

"Yeah," agreed Marie. "We're getting all different colors."

"Let's look at your 'control' test tube results," directed Ms. Lapham. "What color change did you see there?"

"It changed from dark blue to light blue," stated Tomas.

"What does that tell us?" prompted Ms. Lapham.

"That the Benedict's solution will change to lighter blue when you add something it doesn't react with," explained Tomas. "We know that from what we learned in the first food test."

"But I still don't get it," Carla said. "Some of the other tubes turned light blue, but then we got all different colors."

Patiently, Ms. Lapham helped the students focus their attention. "Let's look at your observation chart. Which of the basic test substances caused the Benedict's solution to turn light blue?"

Marie read from the chart. "Corn starch solution, gelatin solution, and cooking oil all changed to light blue."

"And what color did you see in the remaining tube?" Ms. Lapham prompted.

"It turned orangey-red," reported Carla.

"And what substance were you testing?" Ms. Lapham asked.

"Glucose solution," Marie stated.

"What is glucose?" probed Ms. Lapham.

"It's a kind of sugar, isn't it?" suggested Marie.

"Right," confirmed Ms. Lapham. "So, what nutrient does Benedict's solution react with?"

"Sugar!" responded Arnold enthusiastically.

"Does this make sense so far?" Ms. Lapham checked all faces for assent. "Now, which other substances you tested showed light blue?"

"Only the cooked egg white," answered Tomas.

"What does that tell you?"

"That egg white has no sugar in it."

A light seemed to go on inside Freya. "Does that mean that any other color indicated sugar?"

"Exactly, Freya," Ms. Lapham turned to Marie and Carla. "Does that make your results easier to understand?" They both nodded.

"Awesome," marvelled Arnold. "Everything else had sugar in it!"

"So, all the other colors mean sugar?" surmised Carla.

"Yeah, red, brown and even green?" asked Marie.

"You've got it," Ms. Lapham smiled.

As the students' familiarity with the nutrient testing procedures increased, the problems subsided. After the students tested the foods Ms. Lapham brought in, including peanut butter, cold cereal, milk, crackers, and hamburger, Josiah asked, "What about cookies? What would happen if we tested them?"

Rudy spoke up, "How about macaroni and cheese?"

"Or hot dogs?" offered Alicia. The room buzzed with suggestions.

Ms. Lapham raised her hand. "May I speak?"

"Sure, Ms. Lapham," laughed Reggie.

Everyone laughed, including Ms. Lapham. "If you have a food you'd like to test, bring it in tomorrow. We'll add that data to what we have collected so far," suggested Ms. Lapham.

"Awesome. I'm bringin' in bologna. My mom says it's loaded with fat, but I don't believe her," Arnold told Freya.

During the third food test, Ms. Lapham allowed her students to develop their own procedure. She listened to their discussions, focusing her attention on crucial aspects such as use of a control. She assisted each group of students in their efforts to cooperate with each other.

Working this way was new to many of her students. Some didn't like it at first—it seemed too hard and they didn't know exactly what to expect. They were used to "the bargain"—the tacit agreement between some students and some teachers that says "I'll behave myself if you don't push me too hard." Making these kinds of changes in her teaching required some new approaches to classroom management, some "heart-to-heart" talks with students about why this new way of learning was important, and some additional modeling and structuring of class activities.

Higher-Order Thinking: Responsibility for performance of key skills and habits of mind is gradually released to students.

Ms. Lapham slowly cruised the room, listening to the students' conversations, watching their faces. Her presence was noticed by the students and helped some of them stay on task. Most of them, however, simply ignored her unless they had a problem their group could not solve. Ms. Lapham stood next to table 6, listening to the conversation at table 7.

"We're supposed to work this out as a group," said Janine.

"I don't think it will be too hard," suggested Josiah. "We just use the same basic procedure as in the second food test."

"Except we don't have to heat it," Kayli reminded them.

"Right," agreed Ken.

Ms. Lapham stepped up to table 7. "Josiah, how about if you write out the first step of the procedure. Then you can pass the sheet around the table, with each of you writing one step."

"Good idea," encouraged Al. They went to work. Ms. Lapham relaxed and moved on.

At table 4, Craig and Mark were discussing the setup.

"There are four test substances, so we need four test tubes," Mark stated.

"I think we need five," suggested Craig.

"Why?" Mark challenged.

" Remember, we need one for the water — you know, the 'control,'" explained Craig calmly.

"Oh, yeah," recalled Mark, relaxing. "We have to know what it looks like when no reaction takes place."

Ms. Lapham continued around the room and overheard this

discussion at table 2.

"This one is pink and this one is violet," said Carla in a surprised voice.

"I think we should compare the foods to the control, not to each other," Tomas reminded her.

"Oh, yeah, okay," agreed Carla. "But why are there so many different colors in these reactions?"

"Maybe there are different kinds of proteins," suggested Freya.

"Awesome," exclaimed Arnold. "Look, these two are pink, and this one is violet. Do you think that means that egg white and cottage cheese are more alike than peanuts and egg white?"

"Ms. Lapham, is that true?" asked Marie.

"I think we would need to run a few more tests to be sure of the relationship. But that would be a good hypothesis to test. Would you like to try it?" encouraged Ms. Lapham.

"Nah, we'll just stick to these tests for now," decided Arnold.

"So, wait a minute, are these all positive tests for protein — the pink, purple and violet?" asked Carla.

"They're all different than the control, aren't they?" coached Tomas.

"Yeah," admitted Carla. "So, I guess all of them contain protein."

"Hooray," cheered Ms. Lapham silently and continued cruising.

As the experiments progressed, each group recorded its results on large posters around the room, making long lists of foods that contained fats, proteins, sugars and starches. The lists would be used throughout the unit, as a way of bringing students' attention back to specific foods.

While they were spending their class time conducting these experiments, students had the assignment of bringing in food labels and magazine advertisements containing information and claims about health products, vitamins, diet programs, and foods. They used the labels to analyze more complex foods and construct healthy menus, and they discussed and critiqued the claims made in the ads.

As the unit continued, the class explored what happens to food after it enters their bodies. The questions for this part of the unit were: "Where does food go after you swallow it?" and "How is food used by your body for energy and growth?" They started by drawing pictures of the path they thought food follows as it goes through their bodies, and writing explanations of what happens to it along the way.

Most of their initial pictures showed parts of the digestive system: the throat and the stomach, and in a few cases the intestines. Several showed where waste exits the body. Almost none showed any parts of the circulatory system—the blood vessels that carry digested food away from the intestine to every cell of the body.

Ms. Lapham realized this was normal. The annotated teacher's guide for the unit contained notes about students' thinking, which prepared her for typical responses. She read in the guide that while most students know from everyday learning that food gets digested, they do not know that digested food has to go to every cell in the body to be used for energy and growth. Based on the research the unit developers cited, she was not surprised when her students did not include the circulatory system in this initial drawing, but she knew that her task was to get them to understand that food does not just go to the stomach, get digested and somehow "used," and then exit the body as waste. She knew that she had to get them to connect the processes of the digestive system with the processes of the circulatory system, and perhaps even more difficult, to help them understand the biochemical processes that take place in each cell.

Deep Knowledge: Students communicate their findings and express their ideas in a variety of ways, including drawing, writing, and speaking. Alternatives to spoken and written descriptions are often used, including maps, diagrams, flow charts, cutaway views, computer models, etc.

To accomplish this, she would use a combination of computer models, video footage of actual digestive system components, lab activities, simulations and library research to help students piece together a complete picture of how food is used in the body. In one of the lab activities, students investigated how our body's need for oxygen and food relates to our levels of exercising, by collecting data on the body's production of carbon dioxide during exercise. They used the data collected from this investigation to piece together an understanding of the chemical processes going on in our cells when food is used for energy.

SCI.I.1.HS.7 Students learn from a variety of materials, not just the textbook.

Towards the end of the unit, students would use their new understanding to explain what happens when people gain and lose weight. They would actually calculate the weight gained and lost when people eat a meal, use the bathroom, exercise, and simply breathe. This extension activity would help them connect the diets they analyzed earlier with the actual effects of food in their bodies.

At the end of the unit, Ms. Lapham had students construct "healthy eating" posters to be displayed in the middle school. On the posters they were to draw again the path they think food travels after it is eaten, and write about what happens to food in their bodies. She would check their explanations for several key elements:

1) A complete understanding of the flow of food material through the digestive system (mouth, throat, stomach, small intestine) and circulatory system (blood vessels) to the cells (in every part of one's body), including an explanation of digestion. (Each food component is broken into smaller and less complex molecules—proteins into amino acids, fats into fatty acids, and carbohydrates into glucose, which can then pass from the digestive system into the circulatory system; see benchmark/objective SCI.III.2.MS.4, Using Life Science Knowledge about the Organization of Living Things: *Explain how selected systems and processes work together in plants and animals.*)

Connections to the World Beyond the Classroom: Students use mathematics appropriate to understanding the content.

Deep Knowledge: The teacher challenges each student to think deeply about content, to practice the skills they are learning, and to apply what they know to new problems.

2) A chemical description of how digested food is used by cells for energy, including an explanation of the role of breathing in this process. (Cellular respiration is the chemical reaction of glucose [from food] with oxygen [from breathing]—both delivered to cells by the circulatory system; energy is released in this reaction, to power all cell functions, and the by-product of carbon dioxide is carried away from the cells by the circulatory system to be released through breathing; see benchmark/objective SCI.III.1.MS.3, Using Life Science Knowledge about Cells: *Explain how cells use food as a source of energy.*)

3) A description of how we grow by using the food we eat, and why it is important to eat certain foods. (Amino acids from protein-rich foods, along with vitamins and minerals from fruits and vegetables, are delivered to our cells by the circulatory system, then used as building blocks to make hundreds of different proteins, which are used to make the new cells that are added to our existing muscle, bone, and other tissue cells, resulting in growth and weight gain; see benchmarks/objectives SCI.III.2.HS.3 and SCI.III.1.HS.2, Using Life Science Knowledge about the Organization of Living Things: *Explain the process of food storage and food use in organisms*; and Using Life Science Knowledge about Cells: *Explain how multi-cellular organisms grow, based on how cells grow and reproduce.*)

Deep Knowledge: Teachers remediate as necessary.

If their posters still contained naive ideas about digestion and food movement, or about oxygen use and carbon dioxide production, or how weight is gained or lost, she would find additional ways to help individual students come to understand these important ideas.

Richard Jankowski teaches eighth grade Issues in U.S. History— American Studies at the West Hills Middle School in the district of Bloomfield Hills. The goal of the class is to introduce students to the history of the United States as a nation from the age of European colonization through Reconstruction. Emphasis is placed on the study of persisting questions of public policy faced by American citizens. These public issues pertain to themes such as religious liberty, free expression, property rights, privacy, due process of law, equality, immigration, organized labor, foreign policy, and the exercise of power by government.

The course is divided chronologically into eras. Students construct a general understanding of each era and then focus on a public issue characteristic of the era. They pursue the issue by examining its historical origins and its context within the era. Through reading and discussion, they explore their own thinking about the issue and consider opposing points of view. To enhance their ability to make informed decisions as citizens, they compose persuasive essays which express a position on each issue and justify the position with reasoned argument, class discussions, and oral discourse.

SOC.I.2.MS.4 Comprehending the Past: Use historical biographies to explain how events from the past affected the lives of individuals and how some individuals influenced the course of history.

In January, Mr. Jankowski's students began a one-month interdisciplinary unit he named *Immigration*. The unit centered on a series of focus questions, "Does diversity make America stronger?" "What are the advantages and disadvantages of living in a multicultural society?" "Can a nation of diverse ethnic groups balance the wishes of the majority with the rights of minorities?" To explore these questions, the students acquired a strong foundation in the history of the reform era. Students used a variety of resources, employed computers, and conducted personal interviews. The integrated immigration unit included English language arts, mathematics, art, and social studies.

SOC.I.1.MS.1 Time and Chronology: Construct and interpret time lines of people and events from the history of Michigan and the United States through the era of Reconstruction and from the history of other regions of the world.

The intent of the unit on immigration and the reform era was to provide students with a historical perspective on immigration, and then to update the topic by relating it to present-day immigration issues and the public policy concerns they raise. Culminating activities focused on the question, "What should the U.S. public policy be regarding immigration?"

The unit was comprised of approximately 15 different activities. They included:

- ◆ viewing a film and a CNN special on immigration;
- ◆ writing narratives, poetry, a speech, a letter to the editor, and a fictional profile;
- ◆ designing, producing and displaying a stamp;

- conducting interviews with a family member and four recent immigrants;

- using a computer to graph data;

- presenting orally their interviews, poetry, and speeches to the class;

- discussing their understandings and opinions in class regarding immigration, and public policy, the rights of minority groups, and the fairness of current immigration tests; and,

- participating at the swearing-in ceremony of 50 new Americans.

Mr. Jankowski identified 10 benchmarks from five strands of the Michigan Social Studies Framework Content Standards to build this unit on immigration. The strands incorporated historic and geographic perspectives, inquiry, public discourse and decision making, and citizen involvement.

Mr. Jankowski has worked to build a classroom environment where students freely express their ideas in lively class discussions. They are encouraged to explore the implications of their ideas in elaborated responses. During class discussions, Mr. Jankowski acts as a moderator and facilitator. He probes students for deeper consideration of their ideas while maintaining the discussion's primary focus—interaction between the students.

To prepare students for discussion of public policy issues regarding immigration in the present day U.S., students viewed a video on the similarities and differences between historic waves of immigration and present day immigration. They also watched a CNN special which focused on present immigrants to the U.S.

West Hills is fortunate to provide community adult education in English for foreign language speakers during regular school hours. These very recent immigrants became a rich resource for the students. Each student was responsible for conducting four interviews. The interviews included questions about reasons why the person came to the U.S., the problems they have encountered while in America, and their plans and aspirations.

Students also discussed with their own families the history of their family's immigration to the U.S. and explored the challenges and successes of that event. Students in Mr. Jankowski's class are no more than third generation Americans, so their family's experiences were readily available to them. The interviewing, discussing, and writing about immigrants, real and imagined, was an important focus of initial activities. Discussion with their families revolved around why members of the family came to the U.S., who were the first in the family to immigrate, and how did it feel to be a newcomer.

Students were given data on past and current immigration and were asked to construct charts, graphs, and tables using a variety of software programs. They drew conclusions from the

SOC.VI.2.MS.1 Group discussion: Engage each other in conversations which attempt to clarify and resolve national and international policy issues.

SOC.VI.1.MS.1 Identifying and Analyzing Issues: State public policy issues and their related ethical, definitional, and factual issues as questions.

Substantive Conversation: Students gather in-depth information through conversations with the people they interview.

ELA.8.MS.3 Describe and use characteristics of various informational genre to convey ideas.

Connections to the World: Using their own experiences, students explore concepts and ideas related to immigration in today's society.

ELA.9.MS.1 Explore and reflect on universal themes and substantive issues from oral, visual, and written texts.

SOC.V.2.MS.4 Conducting Investigation: Report the results of their investigation including procedures followed and possible alternative conclusions.

SOC.V.1.MS.2 Information Processing: Use traditional and electronic means to organize social science information and to make maps, graphs, and tables.

Deep Knowledge: Students gain a deeper understanding of immigration issues by exploring texts and considering current event issues.

MAT.III.1.MS.1, 2, and 3 Collect, Organize, and Present Data. Students used computers to organize and present data provided to them.
MAT.III.2.MS.1 Describe and Interpret Data. Students developed interpretations from the organized data.

SOC.I.3.MS.4 Analyzing and Interpreting the Past: Compose narratives of events from the history of Michigan and of the United States prior to the era of Reconstruction.

ELA.9.MS.2 Synthesize content from multiple texts representing varied perspectives in order to formulate principles and generalizations.

SOC.VI.1.MS.1 Identifying and Analyzing Issues: State public policy issues and their related ethical, definitional, and factual issues as questions.

ELA.12.MS.1 Differentiate sets of standards for individual use according to the purpose of the communication context.

Higher-Order Thinking: Students apply reasoning skills to analyze arguments and take a position.

graphs and charts about trends in immigration. Eileen McDonald and Nancy Reuter, math teachers, led the activity which incorporated the use of computers, instruction on statistics, and the manipulation and construction of graphic representations of data.

Immigration of the past was explored through readings in English language arts with teacher Sam Washington and in social studies assignments from *American Is* (Merrill 1987), *Immigration* (Public Issues Series, Social Studies Education Consortium), and *Reasoning with Democratic Values* (College Press 1985). To update the issue, a list of current immigration restrictions under consideration by the Federal Government was given to the students. Through class discussion of the proposed immigration restrictions and a technique known as *"four corner discussion,"* students debated what the current U.S. position on immigration should be.

Fourteen days into the unit, the students were assigned a reading entitled "The City of Brotherly Love." This reading detailed a controversy faced by Irish Catholic immigrants in the mid-1800's in Philadelphia.

The students had seven questions to answer for homework to help them focus on the factual information presented. The story focused on the confrontation between largely Protestant nativists and Irish Catholic immigrants over the use of Protestant bibles in public schools. As tempers flared, Catholic churches were threatened by mobs and one was burned. The question presented for class discussion was, "Should Bishop Kendric have allowed guns to defend Catholic churches?" After a full review of the facts of the case using the homework, students were asked to vote on the question presented. The vote took place without discussion and represented the starting point for discussion. Students could choose one of three positions—yes, no, unsure. The majority of the class voted unsure. Students were then encouraged to analyze the ethical issues involved. The teacher led the discussion encouraging students to elaborate on their opinions and clarify their responses. A lively debate took place. All points of view were heard and explored. The ramifications of certain proposed actions or inactions were explored.

Students supported their positions with factual information and the use of analogy. The students evaluated the arguments of other students assessing their persuasiveness. They critiqued arguments which were weak and pointed out flaws in logic. The ethics of defending a place of worship by violent means was hotly debated. Students demonstrated their understanding of the historical era by using it as a context for their arguments. Many students tried to predict the consequences of a particular course of action. Mr. Jankowski encouraged students to present their point of view, while making sure that students were able to add support to their arguments by returning to them for additional comments.

At the conclusion of the spirited debate, in which every student was engaged, a second vote was taken. Almost every student polled now had an opinion which they felt they could strongly defend. The unsure voters dropped to four students.

The following day, students were asked the questions, "What should the school board have done regarding requiring the use of a Protestant bible?" "Does the First Amendment apply to this case, how or why not?" "Does a group, because they represent the majority, have the right to ignore requests of minorities?" "Never?" "Always?" "When?" "What is the fairest way to deal with majority/minority conflicts?"

As students moved toward the conclusion of the unit, the emphasis moved from a historic examination of immigration problems to current immigration issues in the U.S. Letters to the editor stating and supporting their positions were one of the final assignments.

The culminating activities for the unit included the students participating in an actual swearing-in ceremony for 50 immigrants who successfully completed their application to become new citizens of the United States. While the responsibilities for the ceremony and school-hosted reception fell to Mr. Jankowski's class, a majority of the 325 students at West Hills Middle School were involved.

At the conclusion of the unit, Mr. Jankowski's students gained knowledge and insight into the history of immigration in the United States; explored their own family's immigrant history; engaged in an evaluation of decisions made in the past regarding conflicts between immigrants and other established Americans, discovered that there is not one immigrant story, but many different stories, engaged in thoughtful inquiry and discussion regarding current issues involving immigration, explored ethical, political, and economic issues to formulate a position on current immigration policy, and were able to publicly defend their arguments and judge the validity, logic, and effectiveness of a variety of opinions regarding public policy related to immigration.

Student evaluation took place throughout the 20 day unit. Assessment included evaluation of homework, maps, poems, narratives, stamps, vocabulary quizzes, computer graphing, and letters to the editor.

The evaluations reflected objectives set in advance by Mr. Jankowski with an emphasis on the student's ability to analyze, demonstrate an understanding of disciplinary concepts, and express ideas in elaborated written communication.

SOC.VI.1.MS.1 Identifying and Analyzing Issues: State public policy issues and their related ethical, definitional, and factual issues as questions.

Substantive Conversation: Students use discussion skills to present and critique arguments.

SOC.VI.3.MS.1 Persuasive Writing: Compose essays expressing decisions on national and international policy issues.

ELA.6.MS.2 Demonstrate their ability to use different voices in oral and written communication to persuade, inform, entertain, and inspire their audiences.

Connections to the World: Students use their knowledge of immigration issues to explore today's problems.

SOC.VII.1.MS.1 Responsible Personal Conduct: Report how their behavior has been guided by concern for the law.

ELA.10.MS.3 Use oral, visual, and written texts to identify and research issues of importance that confront adolescents, their community, nation, and world.

Higher-Order Thinking: Students are evaluated on the basis of their ability to analyze and make judgments about immigration issues.

This vignette is a composite of real experiences in a typical mathematics classroom. Names are fictitious, but the lesson and interactions among the teacher and students are representative of those found in middle-sized high schools that have diverse populations.

Deep Knowledge: Students are engaged in developing clear distinctions about content knowledge.

Ninth grade students in Ms. Bennett's class explore and investigate mathematical topics where they have the opportunity to develop arguments, solve problems, construct explanations, and work with relatively complex understandings. The students are currently studying a unit about graph models in the *Core-Plus* mathematics program.

The *Core-Plus* instructional materials are built upon the theme of mathematics as sense-making. Each year the program features multiple strands of algebra—functions, geometry—trigonometry, statistics—probability, and discrete mathematics connected by themes of data, representation, shape, change, and chance. Students combine facts and ideas in order to synthesize, generalize, explain, hypothesize, and arrive at conclusions or interpretations.

Higher-Order Thinking: Students are engaged in a lesson where they manipulate information and ideas in ways that transform their meaning and implications.

Instruction and assessment practices are designed to promote mathematical thinking through engaging problem situations that involve students, both in groups and individually, in investigating, conjecturing, verifying, applying, evaluating, and communicating mathematical ideas.

The unit focuses on:

Connections to the World Beyond the Classroom: Topics are related to important mathematics that students encounter in real life.

- ❖ using vertex-edge graphs to represent and analyze real-world situations involving relationships among a finite number of elements, including scheduling, managing conflicts, and finding efficient routes;

- ❖ working in groups to communicate complex mathematical concepts; and,

- ❖ solving problems and making connections within mathematics and other content areas.

MAT.VI.2.HS.3 Students use vertex-edge graphs to solve network problems to find circuits.

Topics within the unit include vertex-edge graph models, optimization, algorithmic problem solving, Euler circuits and paths, matrix representation of graphs, graph coloring, chromatic number, digraphs, and critical path analysis.

The culminating activity for the unit is an investigation of practical applications of the mathematics studied. Various fields are examined with distribution systems and construction scheduling drawing the most attention.

The unit has three lessons entitled *Careful Planning*, *Managing*

Conflicts, and *Scheduling Large Projects*. The lessons have from two to four investigations each.

By the end of Investigation 1 in *Careful Planning,* students have agreed that an efficient route should minimize the total distance. This investigation explores the most efficient route for painting school lockers. It includes getting the equipment from and returning it to the storage room so it will not waste effort on towing equipment past repeated sections, or if it does, this repeated section should be the shortest distance possible. This is written in students' own words in their summary, and then the class proceeds to the next Investigation, 1.2 *Making the Circuit.* The goal of the investigation is to have students find that there are some graphs which can be traced, along each edge once, returning to the beginning, and some which cannot. They are expected to develop their own tests for the existence of a circuit, and algorithms for finding a circuit. The following is a composite picture of several classes struggling with these ideas. Students are working in groups of four.

"Oh, good, I like puzzles," says Sybill, responding to an activity which asks students to try to trace some graphs. "This one is possible, and this, and ...," she continues.

"Are you all tracing these the same way," asks Ms. Bennett, joining the group.

Sybill says, "Yes, there is only one way to do them."

"Oh, really," says the teacher, in a curious voice that students have come to realize probably means there may be more to this than meets the eye.

"Well, I went like this," offers Carshonda, demonstrating with her finger.

"Could you say that out loud?" asks Ms. Bennett.

Carshonda starts, "A-C-D-A-," and almost immediately two other students in the group say they have started at different locations.

"Are all of these methods correct?" asks Ms. Bennett, and watches for a moment as individual students try different starting points. After a couple of silent minutes the group agrees that different starting points are possible for this graph. "Let's look at another graph that Sybill said was traceable," says Ms. Bennett. Three of the students in the group do this, but the fourth person is looking thoughtful. "Do you know what we are doing?" asks Ms. Bennett.

Miguel observes, "If it works, it should work no matter where you start." The others look up. "Well," says Miguel, "the job is just to go along each edge once. It's not like the paint problem where you have to start and stop at the equipment room. Once you know a way that works you could start anywhere in the sequence. Look!" and he writes his method A-C-D-A-F-B-E-G-B-A, in a loop. Others watch and seem to understand. Miguel picks another starting point and continues with the sequence, "C-D-A-F-D-E-F-..." The others are interested but want to get back to finding out which graphs are traceable. Miguel seems pleased

Deep Knowledge: The realistic context of the problem provides an opportunity for students to analyze content relationships within the investigation.

Substantive Conversation: Students become engaged in thoughtful discussions early in the lesson.

Higher-Order Thinking: Students have begun to manipulate information and ideas by exploring, explaining, and hypothesizing with circuits.
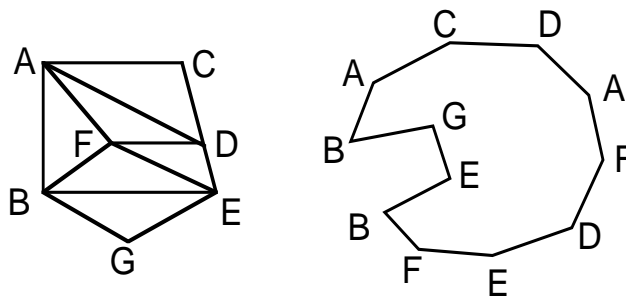
with his insight. Ms. Bennett mentions to Miguel that she would like him to explain this to the class later and moves on to another group.

The next group has already decided which graphs are circuits and which are not. They are now at the stage of drawing some that are circuits and some that are not, sorting them into two piles as directed in the activity. This results in ten examples in the "yes" pile and six in the "no" pile. Students are now asked to think about the differences between the graphs in the two piles.

"There must be a reason why these don't work," says Ms. Bennett, "but it's surely not obvious," and lets the silence continue. "What matters in this type of graph? Is it the lengths of the edges, or the shape of the graph or...?" prompts Ms. Bennett.

The graphs are just vertices and edges joined in a certain way," answers Jerry.

"So it must be something to do with vertices or edges, maybe the number," suggests Nancy. The others listen to this and start to count.

Then Jerry says, "well these have six vertices and don't work, and these have six vertices and do. And this has seven vertices and works, and this has seven and doesn't."

"So, it's not the number of vertices," says Nancy.

Substantive Conversation: Students are engaged in extended conversational exchanges that build an improved and shared understanding of the topic.

Clearly some students follow up on this interchange by counting vertices of different graphs to check the logic of this interchange, but Nancy and Jerry have started to count edges.

"There's always an even number of edges," Jerry announces, "whether it works or not."

"You mean, you can't have a graph with an odd number of edges?" asks Ms. Bennett. She starts to draw a graph, with students suggesting ways to create an odd number of edges. They come up with a graph:
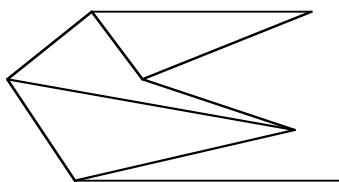
"Oh, I see, this one with an odd number of edges goes into the "no" pile. But how does that help us decide what goes in the

"yes" pile?" Tyrone wonders.

"Why did that last example not work?" asks Ms. Bennett.

"Obvious," says Jerry, "If you start at the vertex with only one edge than you can't possibly get back there. If you don't start there, you have to visit it sometime before the end of the circuit, and when you visit there you can't leave again."

"So your conjecture is that this graph doesn't work because you can't visit and leave this point?" responds Ms. Bennett, using Jerry's language.

Four heads bend very intently over the "yes" pile. "I think I have it," exclaims Tyrone. "Each vertex has to have *visit and leave* edges."

"Sounds like you are onto something," nods Ms. Bennett. "Why don't you check out that conjecture for both piles, and when you are convinced, could you each help another group, by giving them a hint about what to look for?"

Ms. Bennett quickly checks all the groups at this point, and finds that all groups have two piles of graphs. Two of these groups have some roughly formulated ideas about what characteristics a circuit must have. She calls these groups together and asks a spokesperson from each group to summarize their *rules*. As each group offers a *rule*, the other group pushes them for a clearer statement and comes up with counter examples, so, obviously, the rules still need work. As Ms. Bennett listens to the discussion, she notes that the group that came up with a *visit and leave* rule is now circulating around the other groups, offering broad hints about what to look for.

Ms. Bennett draws the class together. She asks, "Who can tell us what characteristics the circuits have that the others don't?" Several students offer variations, some of which are questioned by other students because they are not clear, and some of which are discarded because students can give a counter example. Eventually, Nancy finds a good definition the other students seem to agree with, and Ms. Bennett asks them each to write their own version of this in their notes, with examples of a circuit and non-circuit to illustrate it.

With only five minutes to go, the teacher asks Miguel and his group to come to the front of the room, and explain what they had found out about where to start. Each person was told to make a short statement.

Sybill says, "You always start at the vertex with the most edges."

But Miguel, who has been waiting for this chance, follows up with, "You can start anywhere, if the graph is a circuit."

The third student agrees with Miguel and the fourth draws a simple graph to illustrate starting at different vertices.

Ms. Bennett asks Miguel to give the explanation she'd heard him give earlier.

Deep Knowledge: The activity allows students to explore connections and produce complex understandings.

MAT.I.1.HS.5 Use patterns and reasoning to solve problems and explore new content.

Higher-Order Thinking: Students develop meaning as they analyze, synthesize, and evaluate ideas.

Substantive Conversation: Students present a summary of their hypothesis.

Miguel shares his insights with the rest of the class. His peers listen to him very intently and have a few questions for him.

Nancy comments that this fits with the *visit and leave* rule. "It doesn't matter which vertex you start at, as long as you don't use up your last *visit* too soon."

Seeing that time is up, Ms. Bennett reminds the class of the homework, and adds that an extra part of the homework is to think of two examples where making a circuit would be useful.

As students leave, Ms. Bennett looks over the notes she has made about Miguel, Nancy, Sybill, Jerry, Carshonda and Tyrone. Who is asking questions independently? Who needs to listen to others more carefully? Who needs encouragement to share ideas? Who communicates ideas clearly? What evidence was there of reasoning? Looking over the class list, Ms. Bennett tries to remember if everyone had a chance to participate and makes a mark beside some students who may have been overlooked.

Connections to the World Beyond the Classroom: The activity has value in many real world applications.

The next day students bring examples into class. They included school bus routes, freight train routes, airplane routes, making computer chips and even lawn mowing routes. Every student who had an example was asked to demonstrate with a simple graph and explain what the vertices and edges would model.

Lessons such as the one in this vignette often run for two to three class periods. The students' oral and written summaries validate the time spent on these lessons because it allows students to share ideas and reflect on and internalize new knowledge.

The lessons are connected so at the end of this lesson Ms. Bennett asks the students, "So you know whether a graph is a circuit or not, but how do you actually find a circuit? How do you write the instructions for the pilot of an airplane or a school bus driver?"

Note: The teacher in this vignette has selected the *Core-Plus* program for her ninth grade classrooms after a careful analysis of its content.

There are several excellent mathematics programs available to educators. Selecting a program should be based on a systematic analysis of how well the content addresses the mathematics standards and benchmarks and how well the instruction provides opportunities for students to engage in quality learning experiences that enhance their ability to problem-solve and apply mathematics knowledge to the world beyond the classroom.

USING THE VIGNETTES

Studying the vignettes is an effective way to begin a discussion among teachers about the importance of integrating rigorous content standards and benchmarks with effective standards for teaching and learning. The vignettes point out the importance of teaching for understanding. They serve as an example of the way teachers focus their students' attention on the important content of the curriculum, the content that helps students make connections to the world beyond their classroom and that helps students generate new understandings of the knowledge deemed important by society. They provide examples of how teachers align learning opportunities that engage students in exploring content at high levels of thinking and help them apply knowledge in complex, problem-solving situations that have relevance to their own lives. They illustrate how teachers incorporate higher-order thinking, deep knowledge, substantive conversation, and connections to the world beyond the classroom into the learning experiences they provide their students. They also provide a context for discussing how teachers can integrate into their daily instruction other aspects of curriculum such as strategies that help the classroom:

- ❖ connect with the learner so that all students can learn,
- ❖ utilize technology in meaningful ways,
- ❖ make interdisciplinary connections within and across content areas, and
- ❖ make school-to-work connections within the core content areas which help students understand how school knowledge has relevance to the workplace.

The goal of the vignettes is to show educators how teachers can align curriculum, instruction, and assessment for the purpose of preparing students for further learning and more effective functioning in their lives.

The vignettes offer one way of presenting a clear picture of how instructional practice influences quality learning. They help teachers discover strategies for incorporating the standards and benchmarks into instruction. There are a variety of best practices and methods of instruction, and the ones included in these vignettes illustrate only a sample of the instructional methods that can be used to successfully create an environment in which all students achieve high content standards.

The vignettes are meant to begin a discussion of what best practices might look like. In order to increase their effectiveness, the vignettes should be supplemented with examples from successful teachers in the district who are willing to share how they go about planning instructional opportunities. They should also be supplemented with discussion on research that addresses the characteristics of good instruction. When educators have frequent opportunities to discuss best practice, they develop and refine their teaching skills and learn how to align instruction with curriculum and assessment.

Section V:

Assessment
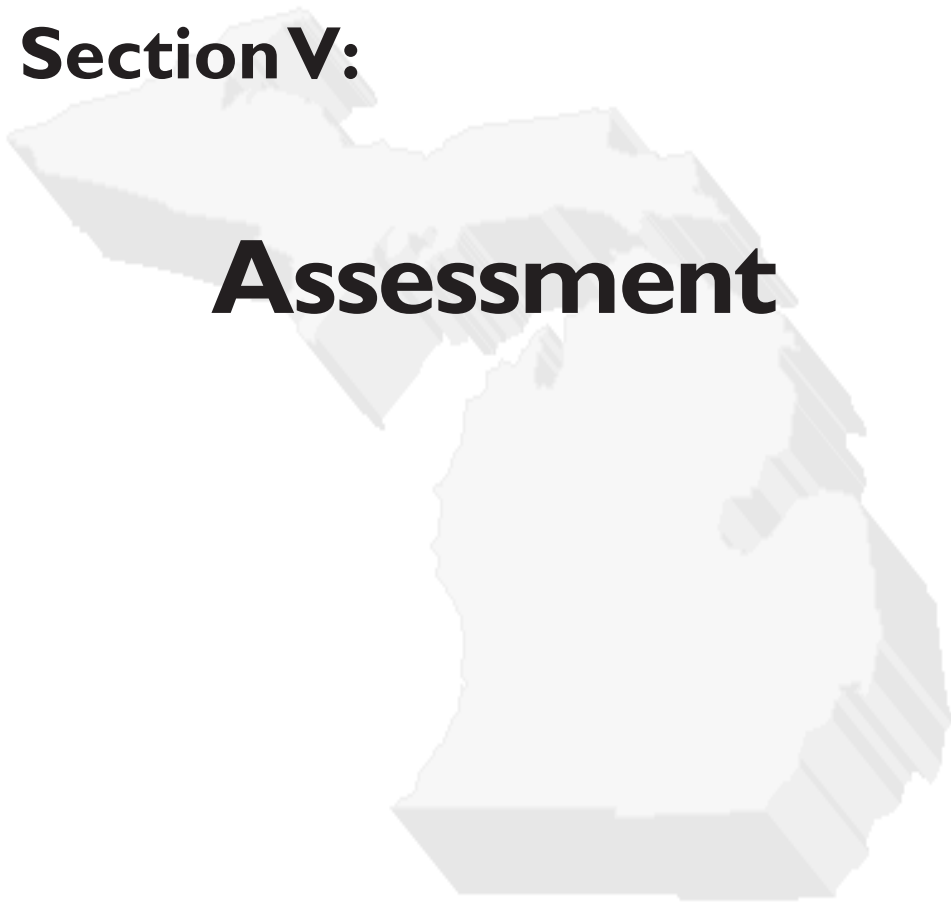
ASSESSMENT

C ontent Standards-Based Assessment: A Learning-Focused System: The preceding sections have presented the new content standards and benchmarks as what students should know and be able to do. The Teaching and Learning section explains the importance of following research-based teaching principles when covering the content standards in classrooms. This chapter is divided into three parts. The first part discusses the broader issues which should be considered by a district as they develop a local assessment system. The second helps teachers assess when their students have reached a level of proficiency relative to the content standards. And the third is a guide for developing the local components of a total assessment system.

Part 1: Why Do We Need an Assessment System?

Robert Marzano (1996) states that at least three factors have contributed to a growing recognition of the need for significant changes in educational assessment practices. The first is the changing nature of educational goals. A quick reading of the English language arts, mathematics, science, or social studies content standards reveals that Michigan has gone beyond the "back to basics" movement and is setting high academic standards for students. The assessments that align with these content standards must also reflect more sophisticated educational goals.

Educational goals are changing.

The second factor contributing to the demand for assessment reform involves the changing notion of the relationship between assessment and the processes of teaching and learning. Marzano presents the following quote from Lori Shepard to make his point:

The relationship between assessment and the process of teaching and learning is changing.

> "The notion that learning comes about by accretion of little bits is outmoded learning theory. Current models of learning based on cognitive psychology contend that learners gain understanding when they construct their own knowledge and develop their own cognitive maps of the interconnections among facts and concepts . . . . Real learning cannot be spoon-fed one skill at a time (Shepard 1989, pp. 5-6)."

This implies that learning occurs in a holistic fashion. An assessment system should, therefore, contain components that provide information about a student's performance at the strand level.

A third factor driving assessment reform is reflected in the following quote from Marzano: ". . .all too many educators can cite specific examples of students who receive credit for a

The type of evidence needed to demonstrate proficiency is changing.

course primarily because they showed up every day, not because they acquired any new knowledge or skills." A number of advocates for assessment reform are calling for a modification of this certification procedure to emphasize the role of demonstrated proficiency judged against established performance standards (Wiggins 1991).

The approach promoted here supports the use of performance standards as the basis of the assessment system. The vision of an assessment system presented in this chapter focuses on the contribution such a system can make toward improving learning for all students. To make this vision a reality, specific questions must be answered about the information needs of various education decision-makers. An assessment system must provide for a variety of information needs such as the following:

◆ *accountability*	◆ *curriculum planning*
◆ *curriculum review*	◆ *educational policy*
◆ *funding*	◆ *instruction*
◆ *placement*	◆ *certification*
◆ *program planning*	◆ *professional development*
◆ *grading*	◆ *self reflection*
◆ *public relations*	◆ *strategic planning*
◆ *educational effectiveness*	

While this is not an exhaustive list of how assessment information can be used, it should give the reader a sense of the scope and complexity of a comprehensive assessment system.

It is also important for curriculum coordinators to recognize how an assessment system can be organized according to decision-making levels. The information needs of various data users differ and are often a function of the primary level of organization for which they are responsible. In this chapter, some possible audiences for assessment information are considered. Their information needs are also identified. Additionally, some suggestions are made regarding the collection of evidence to address these information needs.

Audiences

A wide range of individuals and groups use assessment information for a variety of reasons. Figure 1 shows some of the key audiences and the questions they may be using assessment data to answer. Notice the questions here are restricted to a focus on learning.

Given the numerous audiences and variety of information needs, it should be clear that multiple assessment approaches are required to provide for all of these needs. For this reason

Many information needs are served by an assessment system.

Who needs assessment information?

Figure 1

AUDIENCE	INFORMATION NEED(S)
Student	How close am I coming to my potential ability? How am I doing in school (relative to some content)? Will I meet graduation requirements? Am I prepared to obtain my career goals?
Parent	How well is my child doing in school? Are there areas where I can help her learn more of the key content standards?
Teacher	How are my students doing? What adjustments do I need to make in my units of instruction to insure that my students learn the content standards? Are all of the content standards and benchmarks in my subject area being learned?
Department Chair	What support must I provide to the teachers in this department to help them enhance learning in their students? Are all of the content standards and benchmarks in my subject area being learned?
Principal	How are students in my building meeting the content standards as a group? Where have we shown improvements in learning? Where should I focus resources to improve learning in this school?
Curriculum Coordinator	What gaps remain in our district's curriculum? Which instructional programs are most effective? What professional development needs will district staff face?
Local District Superintendent	How well are the schools in my district meeting the educational needs of our students? Which programs need to be reviewed? What resources are needed to improve learning across the district?
Taxpayer	How well are the schools I support preparing students to function as responsible adults?
Business Community	How well are students being prepared for the world of work? Will our work force be able to continue to compete in a global economy?
Colleges & Universities	How well prepared are students to continue their formal education?
Local School Board	Are districts using their funds to increase student learning? What improvements are needed in our schools?
Superintendent of Public Instruction	What programs can the Michigan Department of Education provide to support learning in our schools?
State Board of Education	Is the state making the best use of its resources to support student learning?
Michigan Accreditation Program	Which schools in the state will benefit most from state level support initiatives?
Educational Researchers	What factors influence learning in our schools? What programs are needed to improve learning?
Legislators	What evidence is available to show the effectiveness of statewide educational policy?
Governor	What do state level indicators tell us about Michigan's educational policies?
National Leaders	How do states compare to each other and the nation as a whole? How do our students compare to those in other countries? What nationwide educational programs are needed to strengthen learning in our students?
Society	ALL OF THE ABOVE

educators are encouraged to direct more attention to developing local assessment components that complement the existing statewide assessment programs.

In addition, relying on one form of assessment can have negative consequences for curriculum and instruction. For

example, relying on only one source of assessment data can narrow the curriculum if that source focuses on only one piece of the curriculum. The use of multiple assessment approaches in an assessment system helps avoid this problem by increasing the range of standards assessed.

Connecting Assessment to Content Standards

For the purpose of this chapter, an assessment system is viewed as an integrated assessment process based on the content standards and benchmarks. It is intended to provide a complete picture of student learning at all levels of the educational organization. It is important to understand that an *assessment system* is distinguished from individual tests or performance tasks. An assessment system is an ongoing coordinated process of collecting information for the purpose of continuously improving student learning.

An assessment system also documents what students know and are able to do in terms of the breadth and depth of their understanding of knowledge and concepts reflected in the content standards. No single assessment instrument exists that can measure the total scope of factual information an individual may possess (and their ability to apply that information and construct new understanding from it) given the constraints of most formal assessment situations. A variety of performance indicators must be repeated and integrated within the context of the learning system. Therefore, the system must be structured so that in total the assessment components describe a complete picture of what students know and are able to do in a holistic way.

The primary purpose of this assessment system is to inform educational decisions made by the individual student and parents, teachers, principals, and superintendents, and thereby, improve learning for all students. The assessment system can only accomplish this by aligning the most appropriate performance indicators (i.e., standards-based achievement measures) with each educational objective using the performance levels as a guide. The performance standards thus form a link between the content standards and benchmarks and the assessment system.

When parents, teachers, and other educators ask the question, "How do I know what students know and are able to do?" the typical response is, "Ask them." This *asking* or assessment can take many forms ranging from an oral exchange to class projects or comprehensive written examinations. The framework projects use performance levels as the basis of an assessment system.

The use of performance levels is critical to the integrity of the assessment system. Building an assessment system without performance standards as a guide would be similar to putting together a picture puzzle without a picture of the completed puzzle. As districts examine their current assessment systems, or pieces thereof, they must keep the total picture in mind.

Performance levels are concrete extensions of content standards. They flesh out content standards in two ways. First, they provide descriptions (and sometimes examples) of what

students are expected to know and be able to do to demonstrate that they have reached specific proficiency levels in the knowledge and skills framed by the content standards. Second, performance levels identify more explicit levels of achievement in each subject matter set out in the content standards. Performance levels set the categories of proficiency for students and allow a judgment of progress to be made for individual students, for schools, and for larger systems.

Eventually, real examples of student work—illustrating performance at each proficiency level—will be available. In conjunction with the performance levels, these examples will help teachers, students, parents, policy makers, and other members of the public understand the substance of local curricular goals and the level of rigor intended. As part of the process to support accountability and certification uses of performance assessments, real student feedback will be needed to address the difficulties in setting performance requirements for untried assessments.

Figure 2 gives some suggestions for identifying performance indicators that can meet the need for assessment information at various organizational levels.

Figure 2

ORGANIZATIONAL LEVEL	POSSIBLE PERFORMANCE INDICATORS
Individual	Graded homework, class projects, clinical interviews, performance tasks, discussions with teachers/parents/classmates, High School Proficiency Test, SAT, ACT, diagnostic tests
Classroom	Teacher-made tests/quizzes, performance assessments, diagnostic tests, observation systems
School	Department level exams, portfolios, MEAP, authentic classroom assessment based on performance levels
District	Standardized tests, MEAP tests, authentic classroom assessment based on performance levels
ISD	Standardized tests, MEAP tests, portfolios
State	Michigan Educational Assessment Program tests, NAEP
Nation	National Assessment of Educational Progress, Third International Mathematics and Science Study

The approach taken here is to describe performance standards in terms of multiple performance levels. This makes it possible to document student progress. In general, performance levels tell one where the student stands with respect to achievement in some area (see Figure 3 below). Performance level

Figure 3

PERFORMANCE LEVEL	DEFINITIONS OF PERFORMANCE LEVELS
Partially Proficient	This level denotes partial mastery of prerequisite knowledge and skills that are fundamental for proficient work at each benchmark level.
Proficient	This level represents solid academic performance for each benchmark assessed. Students reaching this level have demonstrated competency over challenging subject matter, including subject-matter knowledge, application of such knowledge to real-world situations, and analytical skills appropriate to the subject matter.
Advanced	This level signifies superior performance.

descriptions should be developed substantively and empirically in the same way that a single high performance standard should be developed, then they can serve an important pedagogical function by describing how students are progressing along a developmental continuum. That will allow the assessment system to show progress toward proficiency, even for students who are not yet proficient.

Going Beyond MEAP Results

The following example describes a situation where using an assessment system can improve learning from a district perspective. As a local district superintendent, Ms. Jones can get a rough indication of how well schools in her district are meeting the educational needs of students from MEAP results reported each year. MEAP results alone, however, will not tell Ms. Jones how to improve specific educational programs in her district, what professional development programs are needed by instructional staff, or what resources are needed to improve learning across her district. To address these issues a variety of evidence directly related to student learning should be collected using appropriate assessment tools.

In much the same way that teachers may reflect on why their students had trouble with an end of chapter quiz, Ms. Jones could use the MEAP results to pose questions like, *Why are students in high school "A" scoring so much higher year after year in mathematics than students in school "B"?* The answer to this question can only be found by investigating other questions such as:

◆ Are teachers in school "B" following district curriculum guidelines?

◆ Do these teachers follow effective teaching and learning principles in their classes?

◆ Are all students in school "B" given the opportunity to learn all content reflected on MEAP tests as intended?

There are many other possible questions. However, it should be clear by now that Ms. Jones will need to rely on a wide range of data collected over time at the school, classroom, and individual student level to make sound decisions that address this situation.

The intent of the content standards and benchmarks must be clearly understood by the classroom teacher before planning any unit. Teachers need to develop units of instruction which incorporate the appropriate content standards and benchmarks as well as locally identified objectives. The units should reflect issues involving connecting with the learner and the use of technology when appropriate, and should incorporate principles which reflect the best research on current teaching practice.

Classroom units should employ strategies which encourage students to use *higher-order thinking*, engage in repeated opportunities for *substantive conversation*, *explore content in depth*, and be *connected to the world* outside the classroom. The focus of these units should be important ideas and concepts. Time should be spent on examining the true alignment of established programs and texts to the content standards and benchmarks.

Standards for Assessment Tasks

The content standards represent what an individual should know and be able to do to carry out the role of a responsible citizen. As such, they are demanding and rigorous because democracy by its nature demands a great deal of its citizens. A curriculum based on the content standards would have students doing in the classroom what adults must do as good citizens. They would be utilizing disciplinary knowledge to critically analyze information, solve problems, make judgments, enter into discourse with their fellow citizens about civic issues, and act on what they believe to benefit their communities. Students experiencing a curriculum based on these content standards will not be passive recipients of information. The content standards assume that learning is not the simple memorization of collected bodies of knowledge. Rather, learning is the constant search to construct meaning and to make sense of experiences.

The teaching standards link clearly to the content standards in this regard. The teaching standards assume that the curriculum as enacted must allow students the opportunity to practice the kinds of things they will be asked to do as citizens. Teachers must ask students to demonstrate higher-order thinking, they must allow students to pursue ideas in-depth and to discuss them with each other, and they must help students make connections among ideas and between academic ideas and real world experiences. Finally, and most critically, they must confront students with civic questions that involve ethics and values.

What we propose is a set of standards for assessment that is consistent with the vision of good curriculum and instruction that is captured in the content and teaching standards. This vision has students engaged in tasks which are powerful in that they have a potential for cultivating in students the capacities and dispositions necessary for responsible citizenship. They are authentic in that the tasks ask students to construct knowledge which has value, or meaning beyond schooling.

Below are seven standards for assessment tasks developed by the Center on Organization and Restructuring of Schools at the University of Wisconsin. These standards can be used to judge the degree to which an assessment task is both powerful and authentic.

1. ***Organization of Information*** —The task asks students to organize, synthesize, interpret, explain, or evaluate complex information in addressing a concept, problem or issue.

2. ***Consideration of Alternatives*** —The task asks students to consider alternative solutions, strategies, perspectives, or points of view in addressing a concept, problem or issue.

3. ***Disciplinary Content*** —The task asks students to show understanding and/or use ideas, theories, or perspectives considered central to an academic or professional discipline.

4. ***Disciplinary Process*** —The task asks students to use methods of inquiry, research, or communication characteristic of an academic or professional discipline.

5. ***Elaborated Written Communication*** —The task asks students to elaborate on their understanding, explanations, or conclusions through extended writing.

6. ***Problem Connected to the World Beyond the Classroom*** —The task asks students to address a concept, problem or issue that is similar to the one that they have encountered or are likely to encounter in life beyond the classroom.

7. ***Audience Beyond the School*** —The task asks students to communicate their knowledge, present a product or performance, or take some action for an audience beyond the teacher, classroom, and school building.

The relationship between the assessment standards, the content standards, and the teaching standards emphasize a point heard over and over in education recently—***Good assessment is an integral part of good instruction.***

The most effective teaching aligns the content standards with instruction and assessment. At the classroom level, teachers should use the seven standards for the development of assessment tasks to design assessment activities. The assessment tasks can function as part of ongoing assessment conducted throughout a unit or can serve as an end of unit evaluation of progress towards meeting the content standards. The design and implementation of good assessment tasks require reflection and can be time-consuming. Therefore, it will be wise for teachers first engaging in the design of assessment activities to carefully plan when they will be used and how the information received will help improve student learning.

A teacher designing an assessment begins with the standards. A thorough review of the standards and accompanying

benchmarks will focus instruction, and the activities the teacher chooses, on student progress towards meeting the standards. Activities should emphasize connections to the world outside the classroom, acquisition of a depth of knowledge on the topic or concept being explored in the unit, and utilizing higher-order thinking and substantive conversation. The result of emphasizing these principles of authentic instruction is improved intellectual quality in students' work.

Teachers will have to decide first how to assess student learning authentically and, second, how the results of the assessment activity will be scored. Referring to the standards, a decision must be made regarding what the student will be asked to do that will show progress toward achievement of the standards. Independent student inquiry, group discussion, portfolios, a performance, written journals, videos, and visual displays are only a few examples of an extensive list of possible activities.

The next step is to utilize performance levels to score the student's work. Performance levels are concrete extensions of the content standards. They identify explicit levels of achievement and set categories of proficiency. Teachers designing assessment tasks will use performance standards to create specific scoring guides or rubrics for the assessment task. The link between scoring guides and performance standards is critical. Correlating the performance standards and scoring guides allows a judgment of progress towards meeting a content standard to be made for individual students, for schools, and for larger systems.

Creating Scoring Guides

The example that follows is taken from the social studies strand V: Inquiry. The standard is number 2 and the focus is conducting investigations.

> *Inquiry Standard 2: students will conduct investigations by formulating a clear statement of a question, gathering and organizing information from a variety of sources, analyzing and interpreting information, formulating and testing hypotheses, reporting results both orally and in writing, and making use of appropriate technology.*

To create a scoring guide from performance standards, teachers would begin by carefully reading the performance standards. Next, they would make a matrix of the specific elements at four score points using the key words from the benchmarks as the column headings.

Poses a Question	Gathers and Analyzes Information	Constructs Answers Supported with Evidence	Reports Results

The row headings could be score points 4 to 1. To fill in the scoring guide, the teacher would utilize performance standards to describe what is expected for each element for each score point. Score point 3 should be written so that it holistically describes the student who has met the standard. A score point of 4 is a clearly exemplary performance.

Conducting Investigations: Early Elementary

	Poses a Question	Gathers and Analyzes Information	Constructs Answers Supported with Evidence	Reports Results
Score Point 4	Poses a question about life in their school or community.	Information is significant, and the amount collected is in depth and complete; analysis is logical and relevant.	Cites a significant amount of supportive evidence for each answer and elaborates on how the evidence supports the answer.	In a clear and organized way states the question posed, the answer, and discusses gathering evidence elaborating on relevant evidence.
Score Point 3	Poses a question about life in their school or community.	Information is significant, analysis is logical and relevant.	Cites supportive evidence for each answer and explains how the evidence supports the answer.	States the question posed, the answer, and discusses gathering evidence citing relevant evidence.
Score Point 2	Identifies an issue but does not pose it as a question.	Only some of the information is significant; analysis has some errors in logic.	Constructs an answer only after a question is provided; only marginal evidence is offered to support, answer, and explain how evidence supports the answer. Answer is superficial.	Marginal presentation of their investigation with some inaccuracies.
Score Point 1	Cannot identify an issue about life in their school or community.	Information is irrelevant or insignificant.	Constructs an answer only after a question is provided; provides little supportive evidence; cannot explain how the evidence offered supports the answer.	Reports the results of their investigation in disorganized, unclear ways.

When creating the descriptions in the matrix, the teacher will want to *quantify* and *qualify* where appropriate so that students have a clear picture of what is expected. For example: How will the characteristics of a clear and organized report be identified? Will some "process" elements as well as the "content" elements be identified for a score point of 4? These additional elements would be included in the matrix. The descriptions should be as easy to understand as possible, because they will be shared with the students.

The science vignette found in the Teaching and Learning chapter is one of many possible examples of how a local assessment component aligns classroom instruction and assessment with a total assessment system. This unit incorporates benchmarks from four content standards.

A SCIENCE EXAMPLE *(see Science Vignette, Section IV)*

This vignette describes a life science unit ***Food, Energy, and Growth***. A major goal of the unit is to have students connect the processes of the digestive system with the processes of the circulatory system, and to help them understand the biochemical processes that take place in each cell.

To accomplish this the teacher uses a combination of computer models, video footage of actual digestive system components, lab activities, simulations and library research to help students piece together a complete picture of food use in the body. In

one of the lab activities, students investigate how our body's need for oxygen and food relates to our levels of exercising, and collect data on the body's production of carbon dioxide with increasing exercise. The students use the data collected from this investigation to piece together an understanding of the chemical processes going on in the cells when food is used for energy.

To determine how well the students' progress toward meeting the standards emphasized in this unit, the teacher referred to the following performance levels:

Performance Levels—High School Life Sciences

PARTIALLY PROFICIENT	PROFICIENT	ADVANCED
◆ explains the role of nutrients in the body without making a connection of how systems work together	◆ explains and demonstrates how selected systems work in the body to use nutrients for cellular functioning	◆ explains and demonstrates how selected body systems work together to use nutrients in the cells for energy, growth, repair and maintenance
◆ needs more exploration and opportunity to conduct investigations and test how nutrients are used by cells	◆ conducts investigations to verify how nutrients are used by cells, including controlled experiments, data collection and organization	◆ conducts investigative studies in a group to verify how nutrients are used by cells, including the use of controlled experiments and previous research data collection
◆ has difficulty applying or communicating ideas and explanations about the role of nutrients on cellular growth function and the processing of nutrients in the body systems	◆ communicates experimental results successfully, conveying the importance of nutrients and their function in the body	◆ presents explanation about research aspects of the cells' use of nutrients, effectively communicating the importance of nutrients and how they function in cellular reproduction and growth

The Performance Task
The task assigned to the students at the end of the unit has them construct "healthy eating" posters to be displayed in the middle school. On the poster the students are instructed to draw the path food travels after it is eaten, and write about what happens to food in their bodies. The key elements used for evaluating the poster and the writing are contained in the scoring guide that the teacher wrote utilizing the performance levels for the standards being assessed in the task.

Scoring Guide:

4 Scientific concepts and ideas are thoroughly and precisely explained through examples, descriptions and illustrations of how food material flows through the digestive system and the circulatory system to the cells. Written expressions are used to include accurate diagrams, charts, tables, computer graphics or other media to enhance the understanding of specific ideas. These expressions demonstrate how the body grows using food delivered to the cells as building blocks to make protein which makes new cells, resulting in growth and weight gain (application/ communication).

3 Key factors, concepts and ideas are explained to show understanding of how food material flows through the digestive system and the circulatory system to the cells. Written expressions convey significant conclusions and include accurate diagrams to enhance understanding of the body's use of food, delivery to the cells and use of building blocks for growth and tissue development.

2 Suggested or implied explanations are given, describing food material flow through the digestive system and the circulatory system to the cells. Little justification is used to evaluate or support claims of how the body uses food and nutrients to support cellular growth and development. Charts, graphs and drawings are incomplete and inadequately convey scientific knowledge about cellular use of nutrients for growth and development (application/communication).

1 Scientific concepts and ideas about food material flow through the body systems need further exploration. Models to explain the use of nutrients as building blocks by the cells are absent as well as proposed strategies to demonstrate how the body uses food and nutrients to support cellular growth and development. Failure to validate assumptions about cellular use of nutrients is evident in limited communication about conclusions and explanations (application/communication).

INTERDISCIPLINARY EXAMPLE

The following example goes through the same process demonstrated in the previous science unit, utilizing an interdisciplinary approach.

The middle school interdisciplinary vignette found in *Teaching and Learning,* Section IV, is another example of how a local assessment component aligns classroom instruction and assessment to a total assessment system. The teacher constructed this unit around an important idea and a series of focus questions—*Can a nation of diverse ethnic groups balance the wishes of the majority with the rights of minorities?*

This unit incorporates standards and benchmarks for social studies, mathematics, and English language arts. The imperative to align the course content to the content standards and benchmarks was met. The design of previous and future units include the remainder of the middle school benchmarks for the content standards with many of them being covered several times in a variety of contexts. In this way pieces of the assessment puzzle are locked together into a complete picture.

This vignette shows a commitment on the part of a teacher to use a variety of assessment activities to test students' knowledge of the identified benchmarks. These assessment activities were both informal, as in the case of class discussions and substantive conversation about the concepts, and formal in the case of written work, computer graphing, and summary tests. Assessment information is used here both to inform instruction and assign grades, i.e., preliminary, formative, and summative information is used.

PARTIALLY PROFICIENT	*PROFICIENT*	*ADVANCED*
◆ constructs an inadequate information gathering strategy ◆ does not use electronic technology ◆ gathers irrelevant or insufficient data	◆ constructs an information gathering strategy using primary sources and electronic means to complete a task	◆ constructs an information gathering strategy using a variety of sources including little known information resoures to complete a task
◆ uses only one way of organizing information	◆ uses multiple ways of organizing the information	◆ uses multiple ways of organizing the information
◆ makes inaccurate statements based on the information	◆ draws valid inferences from the information	◆ draws valid generalizations from the information

The Information Processing Performance Task

To assess the students' ability to use traditional and electronic means to organize social science information and to make maps, graphs, and tables (SOC.V.1.MS.1-3), students were given the assignment to construct charts, graphs and tables using a variety of software programs and then asked to draw conclusions about trends in immigration. Instruction on the use of computers, statistics, and manipulation and construction of graphic representations of data was supported by the mathematics teachers.

An appropriate scoring guide was disseminated to each of the students at the beginning of the assignment. The scoring guide was based on performance levels identified from the content standards and benchmarks. Notice that the "proficient" level directly reflects the social studies content standards and benchmarks. This example shows how the performance tasks are linked to the content standards through the performance levels.

From these performance levels the teacher wrote the scoring guide, listed below, for the assessment:

Scoring Guide:

4 Charts, graphs, and tables are complete and accurate with all pertinent sources of data provided. Data selected was relevant. More than three ways to organize data were used. Electronic technologies were employed in the construction and organization of data. Inferences drawn from the presented information were exemplary and insightful.

3 Charts, graphs, and tables are complete and accurate with minor flaws or inaccuracies. Pertinent source data was provided. Data selected was relevant. More than two ways to organize data was used. Electronic technologies were employed in the construction and organization of data. Inferences drawn from the presented information were valid.

Scoring the performance task for social studies.

2 Charts, graphs, and tables are minimally complete and accurate with minor flaws or inaccuracies. Pertinent source data was provided. Data selected was only minimally relevant. More than one way to organize data was used. Electronic technologies were employed either in the construction or organization of data. Inferences drawn from the presented information were valid but superficial.

1 Charts, graphs, and tables are incomplete, inaccurate, or the information gathered was irrelevant. Pertinent source data is missing. One way to organize data was used. Electronic technologies were not employed either in the construction or organization of data. Inferences drawn from the presented information were invalid.

Remember that this scoring guide was developed without benefit of student results. Before using this scoring guide the teacher may want to discuss what it means with students so that assessment criteria are clear to everyone. The scoring guide differs from the performance levels in at least three significant ways. First, the scoring guide further specifies the meaning of the performance levels by providing observable/ objective elements that allow the teacher to make inferences about what students know and are able to do. Second, the scoring guide may have different numbers of levels depending on the characteristics being assessed, the purpose, and the number of elements that comprise the scales used.

Finally, the scoring guide represents only a subset of the proficiencies described in the performance levels. This is because the performance levels describe expectations without the limitations imposed when teachers try to measure or provide evidence that those expectations are being met. The scoring guide can't possibly contain all elements present in the performance levels, but it should contain the key elements.

ENGLISH LANGUAGE ARTS PERFORMANCE TASK
This performance task also gave students the opportunity to demonstrate their skills relative to three English language arts content standards. Students were asked to participate in a class discussion. The teacher used this discussion to assess the students' ability to use social science knowledge about immigration patterns to state and support a position concerning a controversial, historical event. Students were given a text to read and analyze, and then asked to take a yes, no, or a "not sure" position on a discussion question. Students were asked to use rhetorical analysis to justify their positions and critique those of others.

The teacher identified the three content standards *listed in the margin* as being addressed in the performance task.

Then the teacher selected appropriate performance level descriptors from the speaking strand. These describe the knowledge and abilities needed to demonstrate expectations for student performance identified in the content standards as related to the use of spoken communication skills.

Performance Levels—Middle School English Language Arts Strand: Speaking

PARTIALLY PROFICIENT	PROFICIENT	ADVANCED
◆ creates spoken responses to express points of view about key ideas and universal themes derived from a variety of texts which express multiple perspectives	◆ uses rhetorical analysis to evaluate key ideas and universal themes derived from oral texts which express multiple perspectives	◆ uses elements of rhetorical analysis to respond to and critique key ideas and universal themes derived from complex oral texts which express multiple perspectives
◆ uses oral communication as a tool for taking responsible action related to important issues, ideas, and problems in their school and community	◆ uses a balance of perspectives to produce oral texts related to important issues, ideas, and problems that impact their community, nation, and world	◆ uses the persuasive power of oral communication as an instrument of responsible change in their community, nation, and world
◆ selects strategies and reflects on their effectiveness in composing oral messages for a variety of audiences and purposes	◆ selects strategies and analyzes their effectiveness in composing oral messages for a variety of audiences and purposes	◆ reflects on and critiques the effectiveness of strategies to compose complex oral texts for a variety of audiences and purposes
◆ uses an increasingly wide variety of verbal and nonverbal elements of the speakers's craft to achieve a purpose for a specified audience	◆ uses more complex verbal and nonverbal elements of the speaker's craft for a wide variety of purposes and audiences	◆ applies vocal, physical, and sophisticated language skills to enhance the meaning of diverse oral texts for various audiences of the message
◆ analyzes and applies different types of proofs and organizational patterns to support ideas in an oral message	◆ discerns the effect of structure on comprehension and manipulates the development of a cognitive position in an oral communication by using several alternative organizational patterns and methods of proof	◆ produces meaningful, structured oral messages on sophisticated topics, using appropriate reasoning patterns that emphasize adequate substantiation for the ideas of the message

Once again, a scoring guide was developed to connect key elements expressed in the performance levels to the actual performance task conducted in the classroom.

Scoring Guide:

4   Comments articulate a thoughtful position, supported by factual information and a well-developed analogy. Thoughtful references reflecting on the quality and strength of argumentation are made to positions taken by other discussion participants. A variety of perspectives are identified and analyzed in relationship to the appropriateness of the position taken by the student. Language is succinct and persuasive.

3   Comments articulate a clear position, supported by factual information which shows the student's understanding of historical context. References are made to the quality of logic and evidence presented by other discussion participants. At least two perspectives are analyzed in relationship to the student's position. Language is clear and relevant.

2   Comments support a position posed by another student. Support is based primarily on factual information. References are made to the clarity of other participants' arguments. At least one other perspective is identified. Language is generally clear, but sometimes redundant.

Scoring the performance task for English Language Arts

1 Comments confirm a position posed by another student. Support is based only upon factual information without regard to historical relevancy. Logic is focused more on preference than strength of evidence. References are made to the student's agreement or disagreement with other students' positions. Only the speaker's perspective is identified. Language is insufficiently developed to clearly express the student's point of view.

The teacher observed individual student performance during the discussion and then assigned each student a number which reflected his/her level of performance.

THE MATHEMATICS PERFORMANCE TASK

The performance task is designed to assess students' ability to collect, organize, present, describe, interpret, draw inferences, and make predictions using data. The sample task is from an interdisciplinary unit where students are to collect and use social science data. The mathematics that students might use in this task is described in the left margin. Although not explicitly stated, the use of technology is implied.

Performance Levels—Middle School Mathematics

PARTIALLY PROFICIENT	PROFICIENT	ADVANCED
◆ collects and explores simple data	◆ collects and explores data through observation, measurement, surveys, sampling techniques, and simulations	◆ collects and explores data, including complicated data, through observation, measurement, surveys, sampling techniques, and simulations
◆ organizes simple data using basic tables, charts, and graphs	◆ organizes data using tables, charts, graphs, spreadsheets, and data bases	◆ organizes data, including complicated data, using tables, charts, graphs, spreadsheets, and data bases
◆ presents simple data using limited representations	◆ presents data using a variety of appropriate representations, and explains why one representation is preferred over another or how a particular representation may bias the presentation	◆ presents data, including complicated data, using the most appropriate representation and gives a rationale for their choice; shows how certain representations may skew the data or bias the presentation
◆ identifies what data are needed to answer a particular question or solve a given problem	◆ identifies what data are needed to answer a particular question or solve a given problem, and designs and implements strategies to obtain, organize, and present those data	◆ identifies what data, including complicated data, are needed to answer a particular question or solve a given problem, and designs and implements strategies to obtain, organize, and present those data
◆ reads and explains simple data	◆ critically reads data from tables, charts, or graphs and explains the source of the data and what the data represent.	◆ critically reads data, including complicated data, from tables, charts, or graphs and explains the source of the data and what the data represent

PARTIALLY PROFICIENT	PROFICIENT	ADVANCED
◆ describes the shape of simple data adequately	◆ describes the shape of a data distribution and identifies the center, the spread, correlations, and any outliers	◆ describes the shape of a data, distribution including complicated data, and determines measures of central tendency, variability, and correlation
◆ draws, explains, or justifies conclusions from simple data	◆ draws, explains, and justifies conclusions based on data	◆ uses the data and their characteristics, including complicated data, to draw and support conclusions
◆ describes and interprets data but inadequately addresses issues of quality including bias	◆ critically questions the sources of data; the techniques used to collect, organize, and present data; the inferences drawn from the data; and the possible sources of bias in the data or their presentation	◆ critically questions the sources of data; the techniques used to collect, organize, and present data; the inferences drawn from the data; and the sources of bias and measures taken to eliminate such bias
◆ formulates basic questions and problems to answer questions	◆ formulates questions and problems, and gathers and interprets data to answer those questions	◆ formulates sophisticated questions and problems, and interprets data to answer those questions
◆ makes and tests simple hypotheses	◆ makes and tests hypotheses	◆ makes and tests sophisticated hypotheses
◆ conducts surveys, samplings, and experiments to solve problems	◆ designs experiments to model and solve problems using sampling, simulations, and controlled investigations	◆ designs investigations to model and solve problems; also employs confidence intervals and curve fitting in analyzing the data
◆ formulates and communicates simple arguments and conclusions	◆ formulates and communicates arguments and conclusions based on data and evaluates their arguments and those of others	◆ formulates and communicates sophisticated arguments and conclusions based on data and evaluates their arguments and those of others
◆ makes predictions based on data	◆ makes predictions and decisions based on data, including interpolations and extrapolations	◆ makes predictions and decisions based on data, including interpolations and extrapolations
◆ makes predictions to answer questions and solve problems	◆ employs investigations, mathematical models, and simulations to make inferences and predictions to answer questions and solve problems	◆ employs investigations, mathematical models, and simulations to make inferences and predictions to answer complicated questions and solve problems

Scoring Guide:

4 Data were thoroughly collected and explored; the data were organized into a useful form and displayed in the most useful format. Data were examined to describe the pertinent characteristics of the distribution; data were precisely related to the context from which it arose and used to answer significant questions convincingly and persuasively. Comprehensive and defensible inferences were drawn about unknown outcomes; predictions were made from the data and the degree of confidence in those predictions was identified.

Scoring the performance task for mathematics

3 Data were thoroughly collected and explored; the data were organized into a useful form and displayed in a useful format. Data were examined to describe the appropriate characteristics of the distribution; data were suitably related to the context from which it arose and used to answer questions convincingly and persuasively. Defensible inferences were drawn about unknown outcomes; predictions were made from the data and the degree of confidence in those predictions was identified.

2 Data were adequately collected and explored; the data were organized into a useful form and displayed in a useful format. Data were examined to describe characteristics of the distribution; data were related to the context from which it arose and used to answer questions convincingly and persuasively. Defensible inferences were drawn about unknown outcomes; acceptable predictions were made.

1 Limited data were collected, organized, or displayed in a useful format. Data were not explored or examined to describe characteristics of the distributions. Context from which the data arose was not discussed or used to answer questions. Weak inferences were drawn about unknown outcomes and questionable predictions were made.

Summary
Each of these examples demonstrate how teachers used performance levels to build scoring guides (rubrics) for assessment tasks. Using performance levels as the basis for the scoring guides which evaluated a student's performance, allowed the teachers in each case to judge the progress towards proficiency of individual students and compare that progress to students in other classrooms in a school or with other students in a district. It is not necessary for each teacher to use the same assessment task. Tasks can vary from classroom to classroom, as long as each teacher evaluates their students using the same performance levels.

What follows is a series of questions to be considered when creating local assessment components. A total assessment system includes assessment done at the state, district, building, classroom, and individual level. Components designed for the local level must include all assessments that are not part of the Michigan Educational Assessment Program (MEAP). They should also include elements that will help students demonstrate their proficiency on statewide tests.

These questions are not intended to be a linear description of how a system is developed. In the development process, many of these issues will be handled simultaneously, and different staff members will lead the process as areas affecting them most directly come under discussion.

What purpose(s) will the local assessment system serve?

When designing the local component of a complete assessment system, the role of classroom assessment must be understood in the context of many broader questions. For example, What purpose will the local assessment system serve? Given that the system will be designed to show the progress of the district towards meeting content standards and benchmarks in the core academic subjects—English language arts, mathematics, science, and social studies—the assessment system should show individual and district progress in achievement of the content standards and benchmarks. One purpose is to diagnose individual strengths and provide information to plan enrichment for individual students. Another is to use the information to make decisions on the purchase of instructional materials, additional technology, and teacher inservice. The purpose of the local assessment system then will incorporate a number of goals.

On what level will the local assessment system be developed?

Once the purpose of the local assessment system is identified, a variety of approaches to local assessment can be devised. Local assessment systems should be developed to support individual, classroom, building, or district level decisions. A hybrid system that identifies the administration of some assessment activities at the classroom level with others administered on a building or district level may be required.

How the results of the assessments are recorded and accumulated is an important corollary question that must be answered. Who will be responsible for the collection of assessment information? Are letter or percentage grades kept by the classroom teacher to be used? Will papers, tests, projects, performances, and evaluations become part of an assessment portfolio? Where will the portfolio be housed? Will a summary of results be created at the end of the semester or school year? Who will have access to the assessment portfolio? Students? Parents?

Does the use of additional standardized tests fill a need?

The use of standardized tests, other than the mandatory

statewide assessments, should be examined. Do these tests align to the content standards and benchmarks? What additional information is provided about student achievement? Are local objectives being assessed on these standardized measures? What role will the results of these assessments play in the local assessment component?

What classroom assessment activities should be planned? Teachers should plan assessment activities that support instruction and assess progress on identified content standards and benchmarks, as well as locally determined objectives. These activities can be identified as formal or informal and should reflect a variety of learning styles. The assessment activities should be an example of student performance that represents construction of knowledge through the use of disciplined inquiry that has some value or meaning beyond success in school.

How should scoring guides reflect the performance levels identified by the content standards and benchmarks? Performance levels should be used to help identify the key elements for a unit of instruction. Teachers should then use the suggested performance levels to develop and set the scoring guides for the activities they will use to assess student achievement. Scoring guides should be shared with students before the assessment is given, so they have a clear understanding of the criteria against which they will be assessed.

After administering and scoring assessments, teachers should have opportunities to examine the performance levels and scoring guides in light of student work. Discussions might center on how well students performed, the instructional implications of the performances, and how scoring guides may need to be changed, strengthened or elaborated. An examination of the level of agreement between teachers on student scores would also be helpful. Finally, do the assessments and the scores emphasize the standards and improve learning?

Reference to the performance levels will assist teachers in focusing their assessments on the mastery of key elements of the benchmarks and standards. Utilizing performance levels will also standardize the critical elements upon which teachers within a building or a district base their assessments of student progress. By standardizing critical elements, teachers will be working toward common goals.

How will progress on meeting the content standards and benchmarks be identified? The question of how assessment results will be used to help students improve learning must be decided. Who needs remediation and how it will be provided is a key consideration here. If a student is routinely performing at the advanced level, how will further instruction on a particular standard be modified?

The results could also be used to evaluate the effectiveness of the curriculum. How should assessment results be used to inform long-term instructional objectives? Equally as

important, the limitations of what the planned assessments don't tell must also be identified.

How will progress on meeting the content standards and benchmarks identified for assessment be reported to students and parents? Explaining the results of the assessment process to students and their parents is critical to continued community support. Parents need to know why the chosen standards were selected as well as how their child is progressing. How will student achievement on content standards and benchmarks be reported? Will parent conferences be held to explain why the content standards were chosen as the focus of instruction? Will parents receive information on student progress on the standards independently from report card grades? Will traditional letter grades or performance descriptions or both be used?

Figure 4

CHARACTERISTICS OF A GOOD LOCAL ASSESSMENT COMPONENT

✔   A well defined purpose;

✔   A policy which outlines the level(s) at which the local assessment system will collect data;

✔   A procedure for collecting assessment data;

✔   A commitment to use standardized tests only if they align to the content standards and benchmarks and locally determined objectives;

✔   Identification of important ideas, concepts and themes of each subject of the core curriculum at each grade level;

✔   Analysis of current units of instruction for their alignment to the content standards and benchmarks;

✔   Integration of assessments to ensure that all content standards and benchmarks are being learned in a meaningful way.

✔   A commitment to a wide variety of assessment activities;

✔   Utilization and evaluation of scoring guides which reflect the performance levels identified by the content standards and benchmarks; and,

✔   A policy which describes how student progress will be reported.

The answer to many of these questions will depend on information needs, the sophistication of audiences, and the resources on hand to put it all together. Figure 4 above, summarizes the characteristics of a good local assessment component.

Completing the Loop

Only the first steps of a very long journey have been described in this chapter. To continuously improve learning and the local assessment components, teachers should use feedback from

students and adjust their instructional plans accordingly. This additional information tells teachers what students know or don't know in the context of the assignments provided in their lessons. Further, real student responses help validate the connections between the tasks required and the performance levels that serve as the basis of the local assessment components.

This process will take time to reach its full potential as a system that improves learning for all students. Considering the magnitude of the task of building an assessment system, districts should expect to take several years to complete the first loop. If it's done right, the system will become self correcting at that point. If educators find that the data collected are not as useful as they could be, further refinements will be required. The more valid and reliable assessment information a district has, the faster it will reach a point where decisions based on those data can be made efficiently and effectively. In either case, most districts will need to do a lot of work to put all of the components of the assessment system into operation.

Making It Happen
Curriculum coordinators across the state have varying levels of resources and expertise they can draw on to build the assessment system begun to be described here. An important place to start is with the district testing and evaluation office. Standards-based reform requires more coordination between teachers, curriculum coordinators, and assessment specialists than ever before. The approach used here emphasizes performance assessment. Content standards and performance tasks are two interdependent and necessary components of a comprehensive assessment system. Assessment results from more traditional sources are also important and should be integrated.

One resource that will be available to assist curriculum coordinators create the local components of a total assessment system is the *Assessment Toolkit*. The Toolkit will be available in December 1997 and will detail the ideas presented in this chapter as well as providing a vignette of a Michigan school district where the creation of a local assessment system is underway. Finally it is suggested that intermediate school districts and local districts explore ways that might combine their resources to provide the time and training needed to develop their assessment systems.

Resource
Marzano, R. J., D. Pickering and J. McTighe (1993). *Assessing Student Outcomes: Performance Assessment Using the Dimensions of Learning Model.* Alexandra, VA: Association for Supervision and Curriculum Development.

Section VI:

Professional Development

PROFESSIONAL DEVELOPMENT

Elizabeth Smith is the third grade teacher and creator of the instructional unit on Community Change featured as the Later Elementary Vignette in the Teaching and Learning section of the Michigan Curriculum Framework. She is a veteran educator who continues to grow professionally because she systematically and intentionally examines her craft and works to improve her practice. She attributes her powerful teaching to her passion for reading professional and nonprofessional texts, listening attentively to colleagues and others, observing how children learn, and to her willingness to take some risks in the classroom — based on her varied life experiences within and beyond the classroom walls at Grayson Elementary School in Waterford.

Personal goals are important to Liz. She regularly sets and refines goals for her own learning, and membership in several state and national professional associations has advanced her growth. She reads and discusses with colleagues the ideas in professional journals and other publications, including those of the National Council of Teachers of English and the National Science Teachers Association.

Throughout the past school year, Liz focused on improvement of her mathematics teaching and parent communication skills. She compiled a portfolio in which she collected and analyzed evidence of personal growth related to her two goal areas. In response to the district's continuing teacher evaluation system, Liz requested that her principal observe her in teaching a mathematics lesson. Feedback was extremely positive as Liz explained the artifacts in her portfolio and how each contributed to her growth as a professional.

As a member of her building school improvement team, Liz believes her learning has been enhanced by collaborating with others on the achievement of building goals, for example, quality writing, which was a specific target area during the past year. Liz contends that in Waterford there is strong alignment of district and building school improvement goal areas, instructional and assessment strategies, and professional development of teachers, with state, district, and building curriculum content standards.

In an attempt to characterize Elizabeth Smith's learning philosophy, the words of nationally known author and teacher-researcher Regie Routman (1996) express it succinctly, "If we want our students to be thinkers, researchers, collaborators, readers, writers, and evaluators, then they need to see us thinking, researching, collaborating, reading, writing, and evaluating. We need, literally, to live the life we're asking them to lead."

> *"Professional development forms a framework for analyzing current practice; it builds the culture for honoring and motivating educators and expanding the learning community; and it forms the foundation for the future."*
>
> Dr. Glenda Lappan, Chair
> Curriculum Framework
> Joint Steering Committee
> (1996)

Elizabeth Smith's efforts to improve her craft exemplify the *Standards for Teaching and Learning* described below as they are applied to the work of the classroom teacher: **higher-order thinking, deep knowledge, substantive conversation, and connections to the world beyond the classroom.** Liz has the same expectations for herself as she has for the students enrolled at Grayson Elementary School.

The *Michigan Curriculum Framework* communicates a vision of teaching and learning that reflects high expectations for the intellectual quality of students and educator performance. If educators are to intellectually engage their students in depth of understanding and breadth of content coverage, they too must be intellectually engaged. Educators must, as a matter of personal responsibility, engage in continuous professional growth and the quest for knowledge as a lifelong pursuit. Quality professional/staff development opportunities provided by the school district and sought as a matter of professional integrity by each educator are essential to ensuring success for all students.

Standards for Teaching and Learning

The expectations for all students set forth through the *Michigan Curriculum Framework* vigorously emphasize intellectual discipline. High expectations for the achievement of intellectually rigorous curriculum content standards presuppose a different approach to teaching and learning for all students. This approach:

- emphasizes the connections between subject areas;
- places paramount importance on the ability to reason, solve problems, apply knowledge, and communicate effectively;
- requires that instructional practices encourage students to learn from active, independent inquiry into life situations; and,
- assumes that all educators become catalysts for students to pursue lifelong quests for learning and continuous growth.

In short, this approach to teaching and learning demands that all educators understand and apply the *Standards for Teaching and Learning* to the educational environment they create in schools and classrooms throughout our state.

The *Standards for Teaching and Learning* are higher-order thinking, deep knowledge, substantive conversation, and connections to the world. They were researched and formulated by Fred Newmann, Walter Secada, and Gary Wehlage of the Wisconsin Center for Education Research, and published in *A Guide to Authentic Instruction and Assessment: Vision, Standards, and Scoring.* These four standards form the foundation of learning and intellectual development. Consequently, it is imperative to consider them when planning an educational environment, whether the environment is being planned for young learners or adult learners. When the standards are applied in a classroom setting, they ensure that students will become actively engaged in their learning. When applied in the professional development of educators within

> *"...you can't have a learning society without learning students, and you can't have learning students without learning teachers."*
>
> Fullan
> (1993)

the context of ongoing, systemic educational reform, the four standards promote the same active engagement in learning. These standards, and some examples of the standards as applied to professional learning, are as follow:

Higher-Order Thinking: When educators are involved in manipulating information and ideas by synthesizing, generalizing, explaining, hypothesizing, or arriving at conclusions that produce new meaning and understandings, they are applying the principles of the higher-order thinking standard. An example of this application occurs when educators are involved in discussions about a new teaching strategy; explanations are made, hypotheses formed, and conclusions drawn relative to the success of the strategy. Different educators derive meaning from the discussion as they apply and adapt the strategies to their classroom settings, share the results, and draw conclusions and/or generalizations about the strategy.

Deep Knowledge: When educators are involved in addressing the central ideas of a topic or discipline with enough thoroughness to explore connections and relationships, and to produce complex understanding, they are applying the principles of the deep knowledge standard. An example of this application occurs when educators participate in curriculum development work and study the possible cross disciplinary connections which can occur between and among such seemingly diverse and separate disciplines as English language arts, mathematics, and social studies. As methods and strategies to teach various units across those three curricular areas evolve, new understanding of each discipline emerges and strengthens teaching across the disciplines, as well as within each separate disciplinary area.

Substantive Conversation: When educators are involved in collegial dialogue and extended conversational exchange with experts and with their peers about subject matter and the educational climate of the school and district in order to build shared understandings, they are applying the principles of the substantive conversation standard. Examples of this application occur when educators work together to identify problems and to design strategies to improve learning within their school. They offer their unique perspectives from classroom experience, challenge commonly held curricular assumptions, participate in peer review, and learn from others' experiences in the classroom, as well as through professional institutes and conferences.

Connections: When educators are involved in making connections between knowledge gained through participation in a community of learners and larger educational or community issues, they are applying the principles of the connections standard. Examples of this application occur as educators explore service learning opportunities and partnerships, share what they have learned with colleagues, structure opportunities for their students to participate in the larger community, and provide structured feedback sessions such that their students and colleagues evolve into a community of learners.

> *"The degree of change is strongly related to the extent to which teachers interact with each other and provide technical help to one another."*
>
> Sparks
> (1990)

In summary, the *Standards for Teaching and Learning* can be used as lenses through which we observe and judge the effectiveness of professional practice. As we shape educational environments for all learners, we must consider learner achievement; our expectations for what learners will know and be able to do as a result of an educational experience; and what skills and knowledge will be required of leaders of the educational experience in order to ensure learning for all.
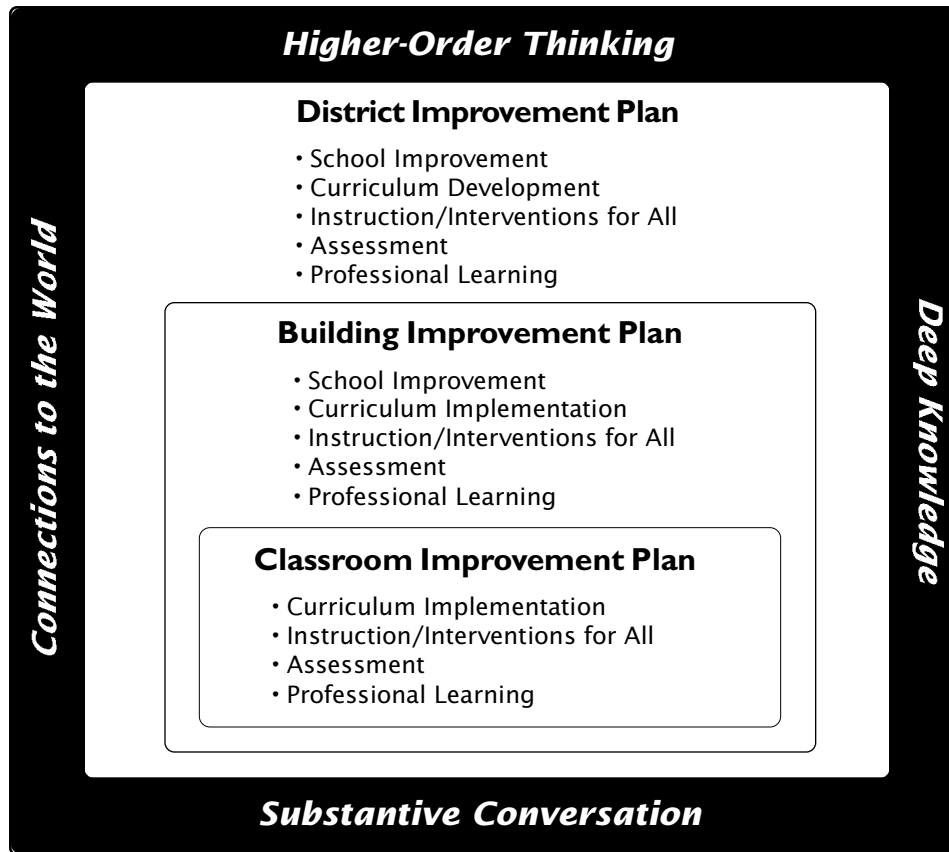
Paradigm Shifts in Professional Learning

Incorporating the *Standards for Teaching and Learning* into the professional development of educators implies a significant shift in our thinking about professional learning. Often traditional professional learning has been limited to brief, isolated inservice presentations which have explored topics of interest to most members of a school staff. Topics are frequently selected for their general applicability, rather than their relationship to district curricula being developed, to instructional and assessment strategies related to implementation of the curricula, or to the targeted problem areas identified through the school improvement process. In this traditional paradigm, staff members are seldom provided with opportunities to operationalize and adapt new learnings, and rarely are they supported with guidance and feedback from coaches and colleagues.

Professional/staff development is effective when it is embedded in the school improvement process and aligned with curricular, instructional, and assessment decisions that result in the improved achievement of all students. Professional learning experiences must be planned within the context of school improvement, a collaborative process at the district, building, and classroom levels. Through the school improvement process, educators identify strengths and weaknesses of the organization and use that information as a basis for making positive changes in their district, buildings, and classrooms. Professional development plans are directly related to the identified needs and the knowledge, skills, and abilities that all educators within the learning community must possess in order to strengthen the organization and meet the needs of all students.

The figure on page 5 portrays professional development that is systemic, contextual, and intellectually rigorous, an important shift away from traditional event-centered approaches to professional learning. The nested boxes illustrate that classroom improvement initiatives are derived from the school improvement plan and that building improvements grow from the district plan. At all three levels of the organization — district, building, and classroom — professional learning is shown to be aligned with school improvement, curriculum, instruction, and assessment. The *Standards for Teaching and Learning* are featured on the graphic because they are pervasive to the organization as they are applied in each of the educational environments.

It is through ongoing and sustained professional development, offered as intellectually stimulating and meaningful learning

Changes in assumptions about professional learning

Operationalizing the learning demanded by systemic reform cannot be accomplished through traditional professional/ staff development.

PARADIGM SHIFTS IN PROFESSIONAL LEARNING

Higher-Order Thinking

Connections to the World

Deep Knowledge

District Improvement Plan

- School Improvement
- Curriculum Development
- Instruction/Interventions for All
- Assessment
- Professional Learning

Building Improvement Plan

- School Improvement
- Curriculum Implementation
- Instruction/Interventions for All
- Assessment
- Professional Learning

Classroom Improvement Plan

- Curriculum Implementation
- Instruction/Interventions for All
- Assessment
- Professional Learning

Substantive Conversation

- ◆ Professional learning involves the application of **deep knowledge** to produce complex understanding;

- ◆ Professional learning involves the application of **higher-order thinking skills** to produce new meaning and understanding;

- ◆ Professional learning involves collegial dialogue and engaging in **substantive conversation** with peers in order to build shared understanding; and,

- ◆ Professional learning involves **making connections** between knowledge gained through participation in a community of learners and larger educational and community issues.

experiences, that educators are encouraged to explore, question, and debate in order to integrate new ideas and strategies into their work with students and colleagues. Little will be accomplished in the new educational reform era without provision for renewal of the teaching and learning process.

To that end, the Michigan State Board of Education approved a definition of quality professional development and developed standards to guide school districts in making decisions about the quality of their professional development activities and strategies. The definition and standards make explicit the relationship which must exist between adult learning and student achievement.

Professional development is standards-driven. It changes practice and leads to increases in student achievement.

Professional Development Definition and Standards

The Michigan State Board of Education promotes professional development, focusing on educators as central to school reform, yet including all members of the learning community, e.g., parents, community members, and all interested stakeholders. The Board defines professional development as *"a continuous process of improvement to promote high standards of academic achievement and responsible citizenship for all students. Professional development increases the capacity of all members of the learning community to pursue life-long learning."*

The *Standards for Professional Development* are organized into three categories: **context**, which addresses the organization or culture in which the new learning will be implemented; **content**, which refers to the skills and knowledge, both pedagogical and disciplinary, that effective educators need to possess or acquire through participation in professional development activities; and **process**, which describes the means for the acquisition of new knowledge and skills.

Standards for the *Context* of Professional Development

Quality professional development, structured and provided within a context of ongoing school improvement planning and a culture of collaboration, improves and sustains the capacity of the adult learner to:

<div style="text-align: right">

Organization or culture in which new learning will be implemented

</div>

- ◆ understand and apply the elements of a market driven education system;
- ◆ understand and apply systemic change principles and anticipate change as a dynamic process;
- ◆ contribute to the plan and design of their own intellectually rigorous professional development;
- ◆ increase personal level of involvement in implementing a continuously improving learning community; and,
- ◆ use data on student academic achievement as the foundation for selecting professional growth alternatives.

Standards for the *Content* of Professional Development

Quality professional development, structured and provided within a context of ongoing school improvement planning and a culture of collaboration, improves and sustains the capacity of the adult learner to:

<div style="text-align: right">

Disciplinary and pedagogical knowledge and skills

</div>

- ◆ demonstrate high learning expectations for all students;
- ◆ demonstrate continuous improvement as a facilitator of student learning;
- ◆ demonstrate continuous progress in developing current content knowledge and its application and the skill-based and instructional strategies required to facilitate effective learning for all students; and,
- ◆ demonstrate knowledge and use of cross-disciplinary instruction and cross-disciplinary teams to facilitate student learning.

Standards for the *Process* of Professional Development

Quality professional development, structured and provided

within a context of ongoing school improvement planning and a culture of collaboration, improves and sustains the capacity of the adult learner to:

- ◆ use inquiry and reflective practice within the learning community;
- ◆ learn from recognized resources within both the public and private sectors, from successful models, and from colleagues and others in the learning community;
- ◆ identify personal and adult learning needs and styles, and select appropriate modes of participation;
- ◆ implement research-based leadership strategies to support and sustain ongoing developmental activities;
- ◆ integrate technologies as tools to assist with the curriculum development, instructional management, and assessment practices; and,
- ◆ invest time in an ongoing process of collegial dialogue, collaborative learning, and exploration of new and/or proven instructional strategies.

Methods of acquiring knowledge and skills

Based on the *Definition* and *Standards for Professional Development*, approved by the State Board of Education in December 1995, staff of the Michigan Department of Education will work to support a statewide infrastructure to place professional development opportunities within the context of school improvement and to provide access to such opportunities for all school communities. Further, the State Board of Education will establish funding criteria and application procedures, and award resources for professional development activities that incorporate the approved definition and standards.

Professional Development Models

The *Standards for Professional Development* serve as a guide for the selection of professional development experiences to enhance educator knowledge of curriculum, instruction, and assessment. Professional development experiences should be selected for their relevance in assisting educators to enable all students to master a rigorous core academic curriculum and to meet or exceed the cognitive school improvement goals set forth in the district and building school improvement plans.

The *Standards for Professional Development* illustrate that professional development can take a variety of shapes and can be delivered in a variety of methods. While professional development can mean participation in workshops and conferences, it is frequently job embedded; that is, professional learning may take the form of curriculum development work, designing instructional interventions with subject area specialists, journaling and sharing experiences with colleagues, reading professional publications, collegial discussions at staff meetings, and a variety of other activities related to the ongoing work of the school.

Dr. Dennis Sparks, Executive Director of the National Staff Development Council, identifies five professional development models: (1) individually guided; (2) observation/assessment; (3) involvement in a curriculum development/school improvement process; (4) training; and (5) inquiry alone and in

learning communities. These five models demonstrate the evolving nature of professional development and suggest that professional development must occur within the context of the ongoing work of school improvement at the local building, in order to maximize the success of participants. This is not to suggest that professional development should occur exclusively at school, with local school personnel only, but rather that a rich array of experiences should be planned for educators within the context of the daily work of the school and the district.

Dr. Sparks' *Five Models of Staff Development* are briefly defined as follows:

1. ***Individually guided professional development*** occurs when teachers plan and participate in activities they believe will promote their own learning. They determine their professional development goals and design activities to meet them — experiences which employ their preferred modes of learning.

2. ***Observation/assessment*** is a model that depends on objective observation, followed by analysis and feedback on what was observed. It can take many forms, including peer coaching, clinical supervision, and teacher evaluation.

> *"Feedback is the breakfast of champions."*
>
> Blanchard and Johnson (1982)

3. ***Involvement in a development/improvement process*** focuses on participation in the design of curriculum and/or the achievement of school improvement goals — often as a member of a building or district curriculum or school improvement committee. Participation in such processes may cause changes in attitudes, as well as the acquisition of important knowledge and skills.

4. ***Training***, the most common form of staff development, has the power to alter teachers' knowledge, attitudes, and instructional skills, as well as student achievement, if all training components are present (exploration/presentation of theory, demonstration and modeling, opportunities for practice, feedback on performance, and ongoing coaching).

5. ***Inquiry*** begins with the identification of a problem, and teachers, individually or collaboratively, explore methods of gathering data. They analyze and interpret the data and make changes in their practice. Finally, new data are collected and analyzed to determine the effects of the change in their classrooms or building.

Certainly, Dr. Sparks enlarges our traditional notion of professional/staff development as only inservice training and workshops. While the five models might be combined in any number of ways, each demonstrates that professional learning is not a series of unrelated episodes, but that it includes follow-up and coaching built into the experience.

Elizabeth Smith, the teacher featured in the introduction to this section, attributes much of her professional growth to collaboration with colleagues. While she engages in all five models of professional development, she is a member of a learning community of educators who work together as they translate what they have learned and experienced into classroom practice in order to increase the achievement of all students. Successful professional learning communities:

- are committed to shared learning goals;
- maintain a climate of trust and openness;
- foster honest communication;
- believe that diversity is advantageous;
- encourage risk taking;
- nurture self-reflection and correction; and,
- promote shared leadership.

If authentic professional growth is to be sustained, a permanent infrastructure of ongoing support for adult learners through learning communities and study groups must be created at the building and district levels.

Steps for Designing a Comprehensive Professional Development Plan

The "Planning" section of the *Michigan Curriculum Framework* describes a method of combining the processes of curriculum development, professional development, and accreditation within the larger system of continuous school improvement. (Please refer to *S*ection III: "Planning" for a detailed discussion.)

The district school improvement committee is working toward the merger of several different district level plans: the school improvement plan; the Title I plan; the curriculum plan; and the district strategic plan. The required components of a local district school improvement plan are shown on pages 6 in Section III: "Planning." The elements of the plan focus mainly on identifying what all students will know and be able to do upon graduation from the district (adult roles), the cognitive goals for all students which lead to the acquisition of the adult roles, and curriculum work to ensure that all students are able to meet or exceed those goals.

District curriculum committees, composed of representatives from the district school improvement committee, work to develop a core academic curriculum in the areas of English language arts, mathematics, science, and social studies. The district curriculum content standards reflect the state content standards and are aligned with the vision, mission, and cognitive goals of the district's school improvement plan. Curriculum benchmarks are articulated K - 12, and benchmark indicators, instructional strategies, and programs are identified. Specific intervention strategies are created for special populations of students, in order to ensure that all students achieve the challenging standards. Simultaneous with the curriculum development work, the rudiments of an assessment plan for monitoring student achievement of the content standards and the basics of a district-wide professional development plan are formulated.

Develop core academic curriculum.

The following outline of steps may be useful as the district committees consider professional development related to the core academic curriculum and cognitive goal expectations for all students.

Step One:
The district school improvement committee identifies professional development needs at the district, building, and classroom level in order to implement the district core academic curriculum. Need can be determined by one or more of the following:

- educator knowledge of the content area standards and benchmarks;

- student performance on MEAP, HSPT, and other assessments;

- educator self-assessment of pedagogical knowledge, including the *Standards for Teaching and Learning;*

- educator understanding of techniques for incorporating interdisciplinary learning, technology, and workplace connections into instruction; and,

- strategies that are customized to meet the needs of all learners in the classroom.

The professional development planning chart (Figure 2) on page 15, may be helpful in analyzing needs. Refer to the center column which describes the "content" of professional development.

Step Two:
(a) The district school improvement committee develops the district professional development plan, using the district identified needs assessment results, the *Definition of and Standards for Professional Development,* and the planning chart (Figure 2) to consider context, content, and process for delivery. The plan includes the following elements:

- goals for adult learning;
- strategies for meeting goals;
- a timeline;
- resources, including professional development providers;
- a budget; and,
- an evaluation plan.

(b) The building level school improvement team develops the building professional development plan, using the building and classroom level identified needs assessment results, the *Definition of and Standards for Professional Development*, and the planning chart. It is closely aligned with the cognitive goals of the district school improvement plan and with the results of student achievement assessments. The building plan contains the same elements as the district level plan.

(c) Each educator develops a personal professional development plan using the building and classroom level

Assess professional development needs.

Develop district, building, and personal professional development plans.

identified needs assessment results, the *Definition of and Standards for Professional Development,* the planning chart, and a personal assessment of need for content area knowledge and pedagogical skills. Personal plans are aligned with the cognitive goals of the district school improvement plan, and coordinated with the professional development initiatives provided through the building level planning.

Step Three:
The district and building school improvement committees initiate implementation of the professional development plans, using the *Definition of and Standards for Professional Development* and the questions on the planning chart (Figure 2) to help guide selection of professional development leaders and trainers, as well as the various methods for delivery.

Implement plans.

Step Four:
At both the district and building levels, time, resources, and opportunities for follow-up, collegial dialogue, and coaching are provided. Time is a critical element, and substantial blocks of time are necessary for forming study groups, planning, sharing, collaborating, and reflecting. Districts across Michigan, such as Battle Creek-Lakeview (616/979-1136), Freemont (616/924-2350), Grand Rapids (616/771-2000), Hillsdale (517/437-4401), Holt (517/694-0401), Ionia (616/527-9280), Negaunee (906/475-4157), Southgate (313/246-4600), Vanderbilt (517/983-4121), Walled Lake (810/960-8300), and Yale (810/387-4274), are discovering innovative methods of creating time for professional learning. Information can be obtained by contacting the school improvement facilitator in each of the districts. Castle and Watts in their Phi Delta Kappan article, entitled*, The Time Dilemma in School Restructuring,* outline six approaches to creating time:

Provide time, resources and follow-up.

1. Using substitutes or releasing students. Some schools are effectively using one morning or afternoon a week for professional development and other related school improvement activities.

2. Purchasing time by using permanent substitutes, retirees, or giving compensation for weekend or summer work.

3. Scheduling time on a regular basis by providing common planning time for teachers working with the same students or teaching the same grade. This is often done in schools using instructional teams, but it can be done in other schools if assistance is provided through block scheduling.

4. Restructuring time by permanently altering teaching responsibilities, the teaching schedule, school day, or calendar year.

5. Making better use of available time and staff by starting meetings promptly, re-prioritizing agenda items, using older students or adult volunteers to provide coverage at recesses, and expediting communication through e-mail and written messages.

6. Using occasional large classes for special topics, for exposure to arts, or presentations of outside "experts" in order to free up teachers to meet.

Step Five:

The professional development plans are evaluated yearly on their attainment of the organization's vision and goals; changes in the practice of teachers and administrators; and on increases in student achievement, as demonstrated on the MEAP/HSPT, as well as district, building, and classroom assessments.

Step Six:

Based on the evaluation, the district and building professional development plans are reviewed yearly and refined and reinvented as needed. All educators in the district are encouraged to evaluate their own professional growth and make yearly revisions in their individual professional development plans as well. These revisions should be based on student achievement data and on changes in district and building organizational goals.

Professional Development Resources

English Language Arts

A manual entitled *Guidelines for the Professional Development of Teachers of English Language Arts* was developed by the Michigan English Language Arts Framework (MELAF) Project Teacher Education Task Force. It is intended for university-based teacher educators, teachers of English language arts, school administrators, and leaders of professional development. Because an integrated view of English language arts requires a re-conceptualization of the discipline, this resource is designed to address the needs of both preservice and inservice English language arts educators at the K-12 levels who must engage in continuous learning and study of their practice. The document includes *assumptions* about English language arts professional development and *six guidelines* accompanied by: *elaboration of the guideline; vignettes* that show guideline principles in action and reflect the state's *Standards for Professional Development*; *focus questions* that suggest ways of responding to the vignettes; and *action implications* that suggest strategies for implementation.

Additional professional development resources, including yearly calendars of events, annual conference news, regional and state workshop schedules, newsletters, and publications are available from the many literacy-related organizations and initiatives in Michigan. The three major professional associations are the Michigan Association of Speech Communications (MASC), the Michigan Council of Teachers of English (MCTE), and the Michigan Reading Association (MRA).

Mathematics

There is a myriad of professional development opportunities in mathematics education. Major statewide initiatives, including *Making Mathematics Accessible to All* (MMAA) and the *Michigan Mathematics Inservice Project* (MMIP), along with hundreds of

local district efforts have been developed and implemented to assist teachers studying issues about content, instruction, and assessment. State and national professional organizations have provided both leadership and resources for professional development.

The National Council of Teachers of Mathematics has developed standards for content, assessment, and professional development. The *Professional Standards for Teaching Mathematics* (NCTM, 1991) document includes four major sections: Standards for Teaching Mathematics; Standards for the Evaluation of the Teaching of Mathematics; Standards for the Professional Development of Teachers of Mathematics; and the Standards for the Support and Development of Mathematics Teachers and Teaching. The document provides elaborations, vignettes, and summaries for each standard. It is an essential tool for those involved in mathematics education.

The Michigan Council of Teachers of Mathematics, the Detroit Area Council of Teachers of Mathematics, and the regional mathematics and science centers have collaborated to provide materials and conferences suitable for the continuing professional development of educators throughout the state. With technology, meaningful professional development that extends to resources beyond conventional activities has become an attractive alternative for many educators. Access to and quality of professional development opportunities will continue to evolve to serve and support educators.

Science
Regional Mathematics and Science Centers provide many services in support of local professional development. Along with workshops and other learning experiences for teachers, they act as resource clearinghouses and disseminate information about statewide programs. Centers are listed in the *Science Education Guidebook*, a resource and planning guide available from the Michigan Center for Career and Technical Education, Michigan State University. The guidebook also contains detailed suggestions for improving professional development related to science teaching, as well as models of curricula for science literacy and approaches to teaching and assessment. Both the Michigan Science Teachers Association and the Metropolitan Detroit Science Teachers Association hold annual conferences with many sessions on science teaching and curricula, as well as exhibits of commercial and nonprofit instructional materials (call your regional mathematics and science center for more information). Colleges, universities, science museums, and nature centers also provide professional development opportunities for teachers.

Social Studies
As part of the Social Studies Frameworks, the Michigan Social Studies Education Project has developed a set of teaching standards to describe the kind of classroom instruction needed to enable students to meet the new curriculum content standards. Four school districts were selected as professional development sites and participated in intensive instruction on the teaching standards called *PASS: Powerful and Authentic Social Studies. PASS* Project teachers developed units that

"Organizations that build in continuous learning and continuous teaching in jobs at all levels will dominate the twenty-first century..."

Drucker
(1992)

incorporated the six standards. Additionally, each professional development site teacher was videotaped. Materials, videotapes, and inservice education on *PASS* teaching standards will be available in the fall of 1997 for schools and districts interested in using the latest scholarship on effective social studies instruction. Information on *PASS* can be obtained from *PASS* Project Manager Dr. David Harris at Oakland Schools. The telephone number is (810) 858-2005.

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PLANNING EFFECTIVE PROFESSIONAL DEVELOPMENT

How might we ensure that the new curriculum doesn't end up on a shelf, that it is more than a paper or written curriculum, and that it becomes the taught and learned curriculum? As educators in local and intermediate school districts use the **Michigan Curriculum Framework** to design K-12 district curricula, they might begin by assessing the professional development needs of their staffs. Building and district-level educators are encouraged to use this chart to reflect on and evaluate their current professional development programs in light of the **Michigan Standards for Professional Development**.

CONTEXT — the organization or culture in which the new learning will be implemented

- Are professional development plans aligned with the goals of the building and district school improvement plans?

- Are all educators in the district encouraged to construct yearly individual professional development plans which reflect building and district plans?

- Are disaggregated student achievement data (including state MEAP/HSPT scores and district, building, and classroom assessment) used in designing and evaluating individual, building, and district professional development plans?

- Are individual, building, and district professional development plans related to ongoing curriculum development planning and elements of the *Michigan Curriculum Framework?*

- Are educators at the classroom, building, and district levels familiar with current research on change and how it applies to professional development planning and the implementation of the Michigan Curriculum Framework?

- Are staff development and inservice activities part of a continuum of interrelated experiences rather than separate events?

- Are building and district professional development plans promoting a culture of collaboration and collegiality?

CONTENT — the knowledge and skills, both disciplinary and pedagogical, that effective educators need to possess or acquire — the actual content of professional development

What is it that educators need to know and be able to do to help all students achieve challenging content standards?

How do sustained professional development plans at the individual, building, and district levels facilitate and enhance educators' understanding about the following?

- The knowledge, skills, and processes embodied in the content standards and benchmarks of the various disciplines within the Michigan Curriculum Framework
- The process of curriculum development based on content standards
- Alignment of instructional and assessment practices to standards-based curriculum
- The design of standards-based units of instruction
- District, building, and classroom implications of MEAP/HSPT
- The creation of a system designed to assess achievement of content standards at the classroom, building, and district levels
- Instructional and assessment strategies which incorporate the *Standards for Teaching and Learning* (higher order thinking, deep knowledge, substantive conversation, and connections to the world beyond the classroom)
- Connecting with the learner — strategies which ensure that all learners have opportunities to achieve at high levels
- Techniques for connecting content standards within, between, and among subject areas and designing interdisciplinary units of instruction
- Use of technology for knowledge acquisition, communication and information management, problem solving, creative expression, research, and design
- Workplace connections, including career exploration, employability skills, applied learning and, coordination with occupational preparation programs

PROCESS — the means for the delivery and acquisition of new knowledge and skills

What processes or professional development delivery systems are used to help adults acquire the professional knowledge and skills needed to facilitate student learning?

Is professional development delivered in a variety of methods? Are educators given opportunities to participate in the five models of professional development as identified by Dennis Sparks? How is each of the following models used?

- Individually guided professional development

- Observation/assessment

- Involvement in curriculum development and school improvement

- Training by recognized resource people within the learning community

- Inquiry and reflective practice

Are adult learning conditions, needs, and styles considered in planning professional development?

Do professional development experiences incorporate the *Standards for Teaching and Learning* (higher order thinking, deep knowledge, substantive conversation, and connections) and nurture the development of an active learning community?

Are sufficient time and opportunity provided for collegial dialogue, as well as study groups, mentoring, peer coaching, and other research-based strategies designed to support and sustain professional growth?

Figure 2

Appendices

Appendix A
Tier II

Tier II Toolkits . . .

Assessment Toolkit – The Assessment Toolkit discusses strategies for creating classroom performance tasks that measure student achievement of the knowledge and abilities identified in the standards and benchmarks. It provides examples of how teachers assess the standards and benchmarks, and it explains how teachers use performance standards and performance descriptors to design scoring guides. It also discusses strategies for creating a local assessment system which provides useful information for assessing content programs and progress on building and district school improvement plans.

Connecting With the Learner Toolkit – In response to the continuous push for reform in mathematics and science education, numerous efforts prevail to address the critical and persistent issues of equity. In an increasingly diverse, complex and technological world, our priority must be that of a scientifically and mathematically literate society. Science and mathematics are culturally valuable components of knowledge that should be accessible to all students. The Connecting with the Learner Toolkit provides suggestions for helping all students achieve high literacy levels. It is consistent with the National Science Standards and other science reform efforts in moving toward interdisciplinary integration. Throughout the document, there is an initial attempt to eliminate a traditional content-bound approach. The toolkit contains several activities that integrate science, mathematics and other content disciplines. Future developments and revisions of the toolkit will include more integrated examples of strategies such as story telling, (English language arts) and opportunities for social and political action (social studies).

Discrepancy Analysis Toolkits – A series of toolkits are needed to help school district staff examine their instructional programs. After conducting these discrepancy analyses, staff will provide data that will help them systematically go about changing programs. Analysis toolkits may be needed in five different areas: curriculum, instruction, assessment, professional development, and operations. Toolkits will be designed so that a district can start analysis from whatever point seems most appropriate. The analyses do not have to be conducted in any particular order.

1. **Analysis of Curriculum** – A discrepancy analysis of the district curriculum will involve the process of analyzing the district curriculum in order to determine if the local curriculum is aligned with the state framework. This will determine if the district K-12 program is covering the standards and benchmarks and will provide data where gaps exist in the district curriculum. Should the district desire to align its program, the kit will provide a process to close those gaps.

2. **Analysis of Instruction** – The instruction toolkit will provide a process for analyzing the instructional strategies in teacher lessons in order to determine alignment. Data from this analysis will show if instructional strategies are designed to help students learn what they are to know and be able to do. For example, if instruction focuses on memory, but the benchmark calls for analysis, alignment is needed. It will help districts analyze alignment between the content of instruction and the standards for teaching and learning.

3. **Analysis of Assessment** – This toolkit will provide a process for analyzing assessment to determine if assessment is indeed measuring the intended outcome of the benchmarks and standards. It will provide data on alignment and coverage. It will help districts analyze local assessment for alignment with curriculum. It will also provide assistance for utilizing both local and state assessment data in the planning process of continuous school improvement.

4. **Analysis of Professional Development** – Analysis of the district professional development program will center on examining how the planning of professional development emerges and whether it addresses the needs of aligned district continuous school improvement. The kit would provide a process for identifying professional development needs and developing a program.

5. **Analysis of School Operations** – A toolkit is needed to analyze whether the combined processes of all of the above are systemic. Are they working together in the school improvement process and planning for improved student achievement? Is the district conducting these processes systemically so that the energies of the organization are operating together and maximizing their human resources? Is district planning driven by local and state assessment data?

Curriculum Integration Toolkit – This resource describes in detail three models of integrating the curriculum content standards - multi-disciplinary, interdisciplinary and integrated. Elementary and secondary examples of these models, as well as a process for designing standards-based units of instruction, are provided. Issues related to curriculum integration, including the use of time and space, team teaching, and the educational implications of brain research, are addressed. A comprehensive bibliography and appendices complete with names of contact people in Michigan schools are also included in the toolkit.

School-To-Work Connections Toolkit – The purpose of this toolkit will be to provide educators with a conceptual overview of important strategies and organization in schools so that students are provided with significant exposure to career relevant information. It will discuss the importance of application of academic knowledge and skills to real-life situations important to adult life roles. It will also provide guidance in creating sufficient interaction with workplace expectations on which to base 1) initial career cluster decisions, 2) determine meaningful career and educational pathways, and 3) to obtain the necessary competencies to successfully enter a chosen area of employment.

Instructional Technology Toolkit – Schools provide the opportunity for students to develop technology knowledge and skills in relevant and meaningful contexts where use and application of the technology is assimilated across all areas of the school curriculum. The instructional technology toolkit is being designed to identify technology uses and applications in each content area and at each grade range. The technology applications will be tied to the content standards and benchmarks and will be built on the teaching and learning principles. Research and multimedia sections will provide bridges across the content areas. A suggested implementation plan including a professional development needs analysis will be included.

Note: The toolkits in Tier II are currently under development. For an update on availability please contact **http://www.mde.state.mi.us**.

On completion, toolkits will be distributed by:

> **The Michigan Center for Career and Technical Education**
> **230 Erickson Hall**
> **Michigan State University**
> **East Lansing, MI 48824-1034**
> **(800) 292-1606 or (517) 353-4397**

Appendix B
Tier III

Tier III Resources . . .

English Language Arts:

A Collection of English Language Arts Vignettes – Detailed descriptions of teaching units which are categorized by grade level cluster and designed to reflect the four principles for Teaching and Learning, the English language arts content standards and benchmarks, and interdisciplinary connections. Created, written, and implemented by Michigan teachers, these units illustrate best practices in English language arts.

Guidelines for the Professional Development of Teachers of English Language Arts – This document presents six guidelines, along with resources and discussion topics for the professional development of the teachers of English language arts, and suggests ways of implementing them. It is intended for those who are involved in planning, implementing, and engaging in professional development.

Profiles of Primary Classrooms – This collection of stories from early elementary classrooms was written by K-2 teachers who repeatedly achieve high results through their early literacy instruction. The profiles feature close-ups of reading instructions, including teaching strategies, monitoring techniques, examples of successful activities, and personal insights.

Readings from the Demonstration Projects – This document is a compilation of text written by K-12 teachers describing their experiences as they created curriculum, instruction, and assessments which reflect the English language arts content standards and benchmarks.

Mathematics:

Mathematics Assessment Framework – The assessment framework is being developed in conjunction with the Michigan Educational Assessment Program's plan for new elementary, middle school, and high school mathematics assessments. The framework will address student assessment in general and will also address how the state assessment program can be used to analyze and improve mathematics programs.

Analysis of Mathematics Instructional and Assessment Materials – A format has been developed and piloted that correlates instructional materials and test instruments to the state mathematics standards and benchmarks. This component examines instructional and assessment activities to identify their focus (i.e., conceptual development, procedural skill, problem solving, or review) and the extent to which the lessons show evidence of higher-order thinking, deep knowledge, substantive conversation, and connections to the world beyond the classroom. The analysis will be done by teachers and will be used to assist in making   decisions about instructional and assessment materials.

Mathematics Professional Development Component – The mathematics professional development resource is an extension of the State Board of Education approved professional development standards with the addition of indicators relevant to mathematics programs. The Michigan Council of Teachers of Mathematics position paper on professional development will be used to describe individual and system responsibilities for modern professional development.

Mathematics Research Component – This resource identifies research relevant to content, instruction, assessment, professional development, and school improvement issues. The research will be linked to the content standards and benchmarks. The purpose of this resource is to provide research information for those who are analyzing and making recommendations for the improvement of mathematics programs.

Mathematics Teaching and Learning Sample Activities – The teaching and learning resource addresses key pedagogical issues and provides sample instruction activities to enhance the content standards and benchmarks. The purpose of this resource is to provide instructional descriptions to the content standards and benchmarks. This resource will be further expanded by electronic connections (e.g., Internet) to include additional examples of instruction aligned to the standards and benchmarks.

Science:

The Model Assessment Items Resource Book – This resource contains more than 540 pages of assessment examples addressing three areas of the MEAP and the High School Proficiency Tests. These include clusters, text critique, and investigations. The tasks were written by teachers and contain student tested and first draft items as well. The model assessment items are aligned with the Michigan Essential Goals and Objectives for Science Education K-12 which is now known as the Science Standards and Benchmarks.

New Directions Science Teaching Units – These units were written by Michigan classroom teachers to show what teaching based on this Framework would be like. Each unit is six-to eight-week in length, self-contained, based on the content standards and benchmarks, with sequenced activity-based lessons. Life science units include *Running on Plants* (3rd or 4th grade), *The Lives of Plants* (5th, 6th, or 7th grade), and *Food,   Energy and Growth* (8th, 9th or 10th grade). Physical science units include *Constructing Toys and Concepts* (K, 1st or 2nd grade), *Hard As Ice* and *Steamed Up!* 5th, 6th or 7th grade), and *Chemistry That Applies* (8th, 9th or 10th grade). Additional information, including how to order, is available in the Science Education Guidebook.

The Science Education Guidebook – This resource provides ideas, tools, and resources for developing and implementing curricula for science literacy. The guidebook is a companion to the content standards and benchmarks, showing how the spirit and vision of the standards and benchmarks can be carried forward into the curriculum and teaching practices. The guidebook also provides suggestions for planning professional development, as well as lists of resources and alternative instructional materials.

Social Studies:

Plan for Statewide Assessment of Social Studies – Describes the social studies MEAP-5, MEAP-8 and the High School Proficiency Test.

Powerful and Authentic Social Studies Professional Development Package – A manual and a set of videotapes of classroom instruction which provide the basis for a long-term professional development program based on the content standards, teaching standards, and assessment standards in the Michigan Framework for Social Studies Education.

Social Studies Curriculum Planning Guide – This guide will assist educators in using the social studies content standards to develop district level curriculum or classroom units of study.

Social Studies (Geography):

Michigan Assessment Prototypes For Geography – Michigan Assessment Prototypes includes sample test questions and assessment activities for elementary, middle school, and high school teachers. The sample assessment materials and scoring guides are consistent with the Michigan Geography Framework and State Social Studies Assessment Plans.

Michigan Geography Framework Poster – The Geography Framework Poster is a two-sided graphic representation of the Michigan content standards in geography and how they can be used to develop local curricula. The front of the poster presents geography content standards, the kinds of activities students should experience repeatedly, and suggestions for assessment. The back of the poster includes the Michigan Assessment Overview, how geography fits into the Michigan Social Studies Framework, and guidelines for using the poster to develop curricula.

Standards Based Geography Units – Standards based geography units are sample units developed by teacher consultants with the Michigan Geographic Alliance. One to two weeks are spent on each unit helping students achieve both the content benchmarks identified in the geography standards and benchmarks associated with at least one of the cross-cutting themes of information processing, conducting investigations, and analyzing issues.

Framework Guides:

Michigan Curriculum Framework: A Guide for Business – This document summarizes the elements of the framework and discusses how members of the business community can collaborate with districts as they design local curriculum. The guide will be useful to school improvement teams as they develop business and community partnerships.

Michigan Curriculum Framework: A Guide for Parents – This document summarizes the elements of the framework and discusses how parents can collaborate with districts as they design local curriculum. The document is written in parent-friendly language and will be useful to school improvement teams as they develop parent involvement programs.

Appendix C
Glossary

Glossary of Terms . . .

Accountability: Reporting a data-based summary of student learning to the public, including identification of system-wide strengths and weaknesses; and specific plans for using the information to improve learning.

Accreditation: An ongoing and collaborative process which confirms that a school has met a set of standards deemed essential for quality education for all students. This accreditation process fosters school improvement, and ensures identifiable progress toward attainment of student outcomes, through requirements for institutional self-evaluation as a stimulus for growth and improvement.

Accredited: Certified by the State Board as having met or exceeded the standards established in the following areas: Administration and organization, curricula, staff, school plant and facilities, school and community relations, and school improvement plans and student outcomes.

Alternative Assessment: Any type of assessment in which students create a response to a question, as opposed to assessments in which students choose a response from a given list, such as multiple-choice, true/false, or matching. Alternative assessments can include short answer questions, essays, performance assessments, oral presentations, demonstrations, exhibitions, and portfolios.

Applied Learning: Learning academic content in the context of work-related and other real-life situations by participating in projects that require students to apply knowledge and skills; activities are frequently experiential, hands-on, and/or laboratory-based.

Assessment: The systematic gathering of evidence to judge a student's demonstration of learning. Assessment aids educational decision making by securing valid and reliable information to indicate whether students have learned what is expected. Assessment is built around multiple indicators and sources of evidence (combinations of performances, products, exhibitions, discourse, tests, etc.).

Assessment Standards: Principles for the assessment and analysis of student achievement and the opportunity afforded students to learn; the methods for achieving appropriate correspondence between the assessment information collected and the purposes that information will serve; the characteristics of valid and reliable assessment information; a variety of methods for collecting it; and appropriate concerns for reporting and interpreting the information.

Assessment System: An ongoing coordinated process for collecting objective information for the purpose of continuously improving student learning.

Authentic Assessment: Assessment tasks that elicit demonstrations of knowledge and skills in ways that resemble "real life" as closely as possible, engage students in activity, and reflect sound instructional practice.

Benchmarks: Statements which indicate what students should know and be able to do at various developmental levels (i.e., early/later elementary school, middle school, and high school).

Career Exploration: Learning about a variety of career options through awareness activities, interviews, and on-the-job experiences.

Content: Subject matter from the disciplines of English language arts, mathematics, science, and social studies.

Content Standards: What students should know and be able to do. Content standards are broad descriptions of the knowledge and skills students should acquire in the core academic subjects. The knowledge includes the important and enduring ideas, concepts, issues, and information. The skills include the ways of thinking, working, communication, reasoning, and investigating that characterize each subject area. Content standards may emphasize interdisciplinary themes as well as concepts in the core academic subjects.

Core Curriculum: A plan for learning that defines the essential learnings for all students and the instructional system that will be used to deliver these learnings.

Curriculum: A coherent plan for instruction and learning. Curriculum serves as the basis for teachers' and students' active involvement in the construction and application of knowledge.

Curriculum Alignment: The process of integrating and sequencing what is to be taught between, among, and within the elementary, middle, and high school levels. Curriculum alignment occurs when the standards for all learners are agreed upon and written (curriculum), the standards are reflected in the instructional delivery program (instruction), and the learner is assessed to determine if the standards have been achieved (assessment).

Curriculum Framework: A document (usually developed at the state level) that suggests the best thinking about the knowledge, skills, and processes students should know and understand about a particular discipline, and that provides a structure within which to organize the other important curricular components of the instructional system, including standards, professional preparation of teachers, strategies for instruction, materials selection, suggestions for teaching diverse populations, technology, and assessment.

Employability Skills: General skills needed in the workplace as identified by employers and community representatives including personal management, teamwork, developing and presenting information, problem solving, organizational skills, negotiation skills, understanding systems, using technology, career planning, and securing employment and/or pursuing continuing education.

Evaluation: Judgments made about student performance and program efficacy based on quality information gathered systematically over time.

Holistic Scoring: Scoring based on an overall impression of a work rather than on an accumulation of points.

Instruction: The decisions and actions of teachers before, during, and after teaching to increase the probability of student learning.

Integrated Academic and Career Curriculum (Thematic Instruction): Designed activities or projects that align to a number of curriculum content standards linked by a broad theme of high interest based in real life and frequently relevant to various workplace and community problems.

Local Curriculum: A plan for learning which is developed and supported by the local school district; it includes the content of what is to be learned and a process to deliver the content to all students.

Michigan Model Core Curriculum: A K-12 plan for learning developed by the Michigan Department of Education, that includes seven broad student outcomes and other specific student outcomes in nine curricular areas; its purpose is to guide districts in the development of a local curriculum.

Performance Assessment: Assessment that is based on observation and judgment of student created products and/or performances; intended to provide a rich portrait of student learning.

Performance Standards: Indicators which establish the degree or quality of a student's performance. Sometimes levels of performance are used, such as: partially proficient, proficient, and advanced.

Performance Tasks: Short- or long-term activities or demonstrations that include rich opportunities to learn and systematic opportunities to assess the quality of student work.

Professional Development: A continuous process of improvement to promote high standards of academic achievement and responsible citizenship for all students. Professional development increases the capacity of all members of the learning community to pursue life long learning.

Proficiency: Description of what a person who possesses the qualities articulated in a standard understands or can do; identifies quality criteria with which to evaluate products and performances and develops products and performances that meet those criteria.

Reliability: An indication of the consistency of scores across evaluators, over time, or across different versions of the test. An assessment is considered reliable when the same answers receive the same score no matter when the assessment occurs or how or who does the scoring, or when students receive the same scores no matter which version of the test they took.

Rubric: An established and written-down set of criteria for scoring or rating students' performance on test, portfolios, writing samples, or other performance tasks. Also known as Scoring Guides.

School Improvement: School improvement is a collaborative process through which staff identifies strengths and weaknesses of the school program and uses that information as a basis for making positive changes in observable and measurable student outcomes.

Scoring Guide: A scoring guide is a tool for evaluating student performance on an assessment task. It includes a set of criteria used to compute a score that represents the caliber of a student's performance. These criteria are sometimes called a rubric.

Standard: An agreed upon level of performance that demonstrates proficiency or achievement.

Standardized Tests: Assessments that are administered and scored in exactly the same way for all students. Traditional standardized tests are typically mass-produced and machine-scored and are designed to measure skills and knowledge that are thought to be taught to all students in a fairly standardized way. Performance assessments can also be standardized if they are administered and scored in the same way for all students. Standardization is an important consideration if comparisons are to be made between scores of different individuals or groups.

Strands: Clusters of related content standards often representing disciplines (geometry, physical science, or history) or a cross-cutting theme (inquiry).

Validity: An indication of how well an assessment actually measures what it is supposed to measure rather than extraneous features. For example, a valid assessment of mathematics problem solving would measure the student's ability to solve mathematics problems and not the ability to read the problems.

Vignette: A narrative or story describing how the content standards, teaching and learning standards, assessment standards, and professional development standards are put into practice. A key characteristic of vignettes is that they chronicle real life examples of educators who are experiencing the challenge of translating theory into practice.

Vision: A description of the philosophy and ideals upon which curriculum, instruction, and assessment are based.

Appendix D
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