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Core Curriculum Content Standards

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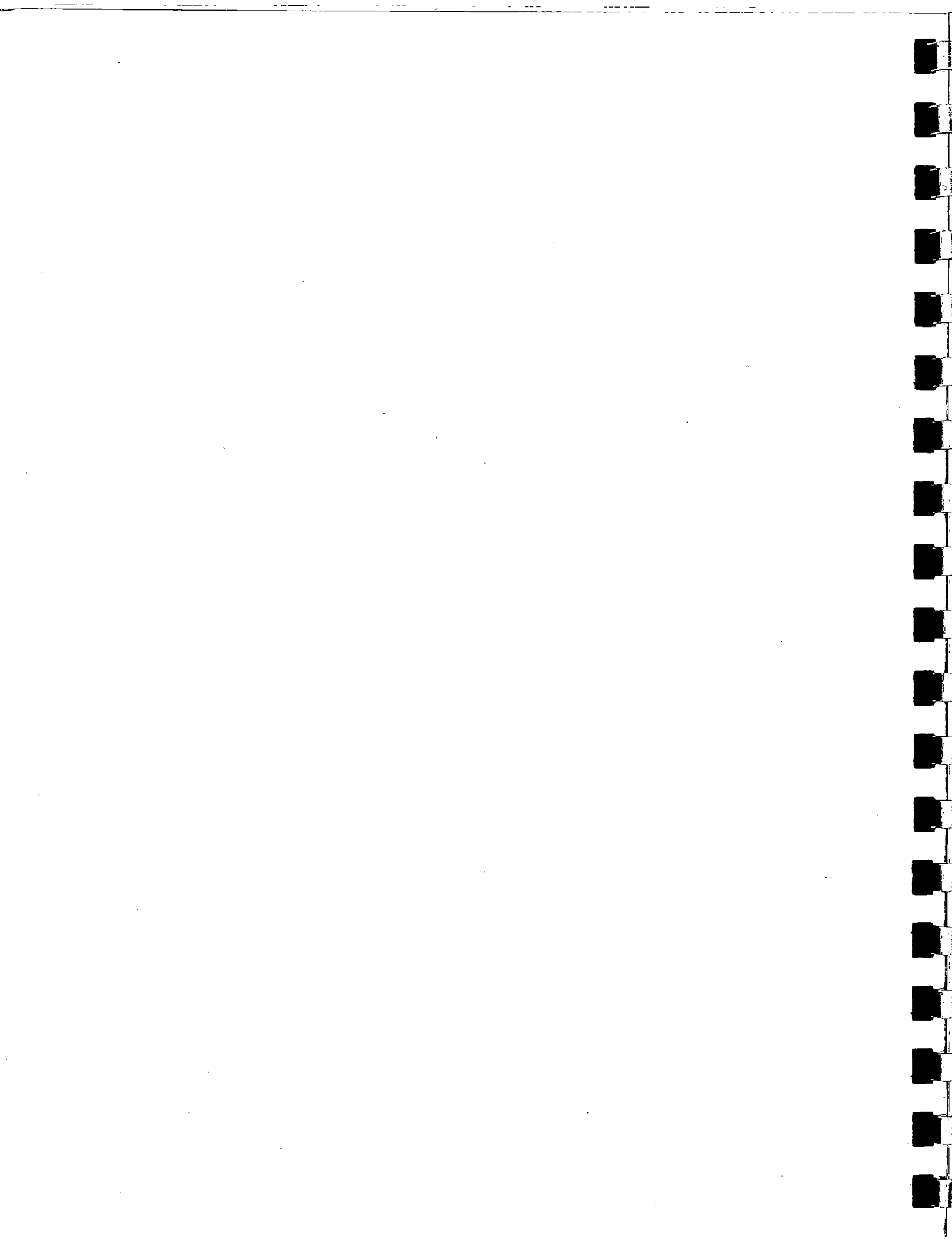
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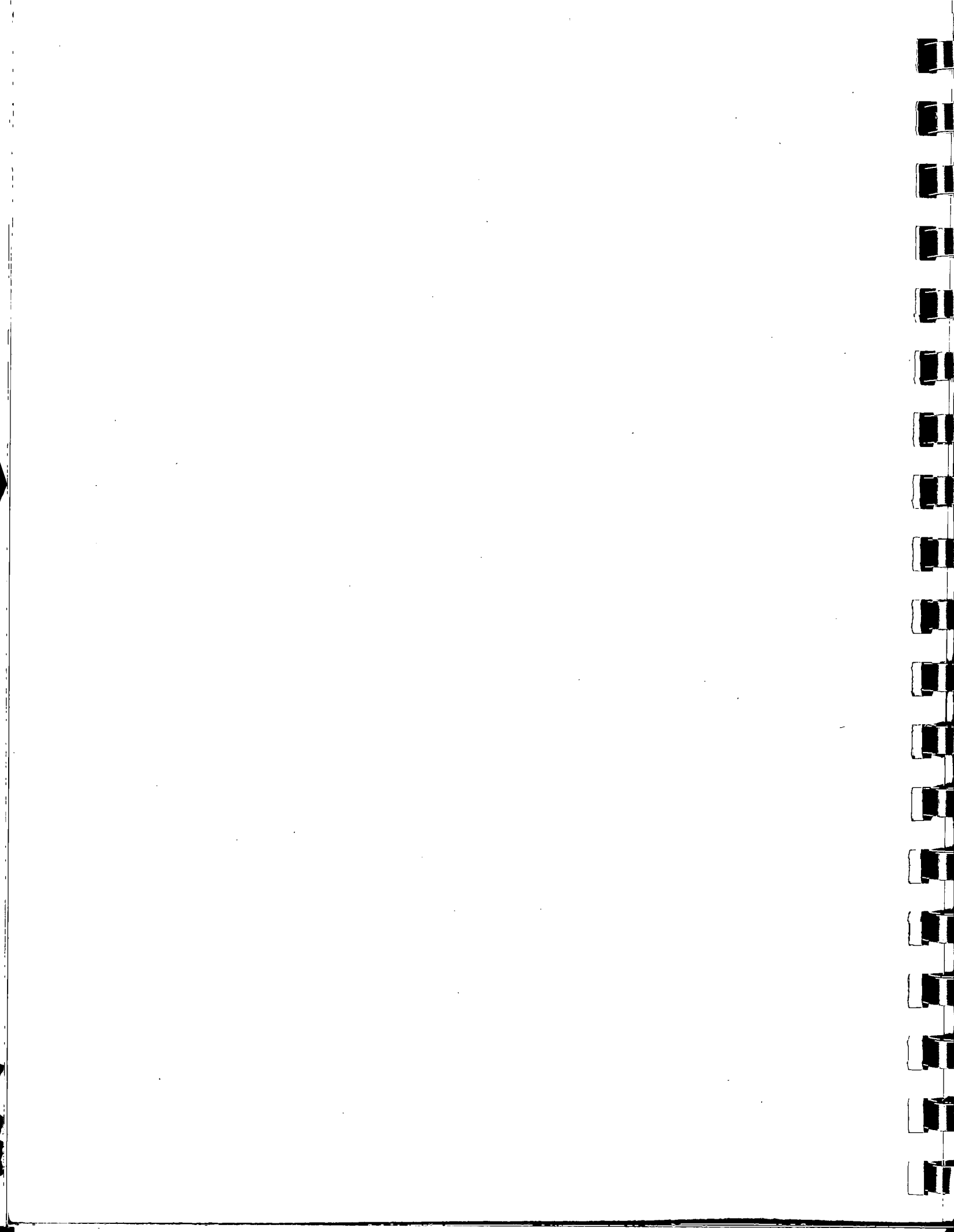
The New Jersey Department of Education gratefully acknowledges the thoughtful contributions and outstanding efforts of over 200 educators, parents, business persons, and other citizens who have worked on the Standards Project. We especially appreciate the tireless efforts of the 1995 Working Group cochairpersons, who involved thousands of other New Jersey citizens in the standards-setting process and the ground-breaking work of their 1992-93 predecessors. In addition, we are grateful for the testimony and correspondence of hundreds of citizens who responded to the proposed standards prepared by the Department of Education. The final version also benefited from the guidance of the New Jersey State Assembly Task Force on Core Curriculum Standards and from the State Senate Education Committee.

Thanks to the commitment of so many dedicated citizens, New Jersey has defined what knowledge and skills all students need to meet the challenges of the twenty-first century.

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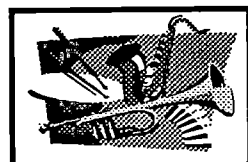
New Jersey
Core Curriculum Content Standards

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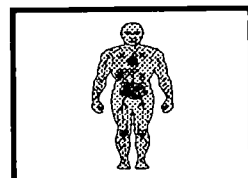
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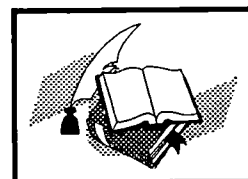
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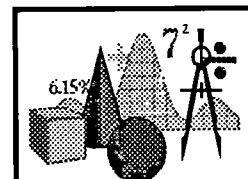
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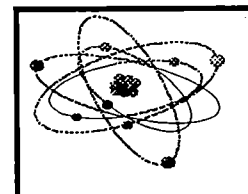
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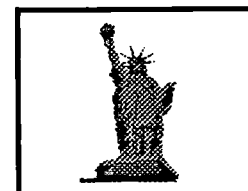
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New Jersey Core Curriculum Content Standards

Introduction

At the threshold to the twenty-first century, New Jersey finds itself struggling along with the rest of the nation to educate citizens who will be competitive in the international marketplace of the future. New Jersey also faces a particular constitutional challenge of implementing a state system of "Thorough and Efficient" public schools.

New Jersey wrestles with a paradox regarding the governance of public education. Ours is a state with a 120-year-old constitutional guarantee that regardless of residency, its children will receive a "Thorough and Efficient" education. Throughout this same time period, the State has evolved into approximately 600 independent school districts that exercise considerable "local control." Confronting the State, therefore, is the issue of how to ensure that all children receive a "T&E" education. This challenge is exacerbated by the fact that each district determines its own curriculum.

Core curriculum content standards are an attempt to define the meaning of "Thorough" in the context of the 1875 State constitutional guarantee that students would be educated within a Thorough and Efficient system of free public schools. They describe what all students should know and be able to do upon completion of a thirteen-year public education.

These standards are not meant to serve as a statewide curriculum guide. They define the results expected but do not limit district strategies for how to ensure that their students achieve these expectations. To assist local educators, the standards will be further elaborated through curriculum frameworks. While also not a curriculum, these frameworks will bring to life the intent of the standards through classroom examples and a discussion of the underlying rationales. Local curriculum developers can use the frameworks as a resource to develop district curricula that best meet the needs of the students in each community. Curriculum frameworks also serve as a resource to classroom teachers and to staff developers who want to modify instruction in light of the new standards.

Since our schools need to produce both excellent thinkers and excellent doers, the core curriculum content standards describe what students **should know and be able to do** in specific academic areas and across disciplines. Content standards are concerned with the knowledge students should acquire and the skills they should develop in the course of their K-12 experience. That is why each of the content standards is further described in terms of cumulative progress indicators at specific benchmark grades of 4, 8, and 12. Over the next few years, the content standards will be further defined through the attachment of performance tasks and levels which will be determined as the standards are integrated into the state assessment program.

These standards will directly influence the new grade four test and the current state assessment program at grade 8 (Early Warning Test) and at grade 11 (High School Proficiency Test). In future years, the core curriculum standards will define the State's high school graduation requirements. In their broadest application, these standards will establish the foundation upon which students can build as they pursue further learning and careers.

The standards emerged from the efforts of two different groups that worked one after another for a total of fifteen months in 1992-93 and 1995. In 1992-93, panels of educators, business people and other citizens developed preliminary draft standards in seven academic areas and career education. During 1995, similarly constituted working groups built upon these preliminary standards and engaged the public in a review process that resulted in several revised drafts.

The 1995 working groups submitted a total of 85 standards comprised of 1195 indicators to the Department of Education. The department reviewed the standards proposed for eight content areas and extracted the following five cross-content workplace readiness standards which apply to all areas of instruction:

1. All students will develop career planning and workplace readiness skills.
2. All students will use technology, information, and other tools.
3. All students will use critical thinking, decision-making, and problem-solving skills.
4. All students will demonstrate self-management skills.
5. All students will apply safety principles.

Through these five cross-content workplace readiness standards, the knowledge and skills associated with career education have been elevated in importance for all instructional areas. As a pilot state for the federal "School-to-Work" initiative, New Jersey emphasizes the importance of every student linking school-based learning with a career major and of having both school-based and work-based learning experiences. Since one of the goals of public education is to prepare students for the world of work, it is important that these standards be addressed through all content areas.

The department also emphasized the essential results expected for students by distilling the working groups' recommendations into 56 standards covering the following seven academic content areas:

Visual and Performing Arts	Mathematics
Comprehensive Health and Physical Education	Science
Language Arts/Literacy	Social Studies
	World Languages

The humanities, which explore the human condition, have been integrated throughout the discrete academic content areas. They have not been treated as a separate content area because they are by definition interdisciplinary. Likewise, several other specific curriculum areas have not been designated as separate components of the core curriculum. These include family and consumer science, technology education, business education and other occupational areas. However, these content areas can contribute to students' achieving the expected results set forth in the standards, especially the cross-content workplace readiness standards. In addition, these programs provide students with opportunities to apply, and thereby reinforce, learning from the core curriculum content areas.

While the standards areas include concepts that can be measured in a uniform manner, they do not include the affective domain, which addresses areas of self-esteem, emotions, feelings, and personal values. Certainly, students' intellectual growth is affected by their emotional disposition. However, the Department of Education excluded desirable affective results from the content standards which the State would formally assess, because it would be inappropriate for the State to make judgments about student values or feelings. The department's position is that parents and local educators should make judgments about when and how these affective issues will be addressed in their communities. Teachers, administrators, parents, and other community residents all have a responsibility to nurture and communicate the values, self-worth, and character development required for young people to succeed.

Although the standards have been organized into seven separate academic areas and five cross-content workplace readiness standards, this is not meant to imply that each standard can be met only through courses in a formal school setting. The application of knowledge from all content areas can be reinforced through experiences beyond the school walls, such as volunteer activities, job shadowing, and part-time jobs.

Other parts of the educational system and the larger community can be used to deliver an integrated curriculum. For example, career education should be incorporated into all seven content areas as well as into occupational education programs. Language arts and literacy skills are key to success in all areas of learning. Science is an important part of health education and

represents an important part of the historical record. Mathematics skills are tools for problem-solving in science and can be reinforced in vocational-technical areas. Technology education teachers can show the application of problem-solving techniques which bring physics principles to life. Family and consumer sciences (home economics) draws on health and science in preparing students for family living. The visual and performing arts provide an avenue for the understanding of science, social studies, language arts, world languages, and design technology.

In one sense, these core curriculum content standards mark with precision the results expected of all students. In another sense, they serve as a banner behind which all segments of the education community and the state at large can mobilize to reshape our approach to education. Collectively, they embody a vision of the skills and understandings all of New Jersey's children need to step forward into the twenty-first century and to be successful in their careers and daily lives.

The Need

We live in an age of exploding knowledge and rapid change in technology, information exchange, and communications. The changes which are taking place in our society have increased the demand for internationally competitive workers and for an educational system designed to meet that demand. Because today's students will be employed through the middle of the twenty-first century, they will need increasingly advanced levels of knowledge and skill. To gain and retain high-wage employment that provides job satisfaction, they will also need to continue to learn throughout their lives.

To compete in a global, information-based economy, the students we prepare must be able to solve real problems, reason effectively, and make logical connections. The world of work they enter will feature products and factories that are designed by mathematical models and computer simulations, computers that control production processes and plants, and robots. Our state and country need people with the skills to develop and manage these new technologies.

The first step in preparing individuals for the workplace, for further learning, and for daily living is to set internationally competitive standards which define educational excellence for **all students**. The need exists to redefine the mission for all parts of the educational system. From the schoolhouse to the statehouse, we must focus on high student academic achievement. Our children and our society will be better served by higher expectations, by curricula which go far beyond basic skills, and by programs which include a variety of learning models and devote a greater percentage of instructional time to problem-solving, critical thinking, and active learning.

All students should be challenged to reach their maximum potential. For many students the achievement of these standards will indeed be challenging. However, if we do not provide such a challenge, a blueprint for excellence, we will do our students a great disservice by leaving them unprepared for the future. The standards contained in this document aim to define this excellence.

Issues of Implementation

The core curriculum content standards are intended for virtually all students. The term "all students" includes students who are college-bound, career-bound, academically talented, those whose native language is not English, those with disabilities, students with learning deficits, and students from diverse socioeconomic (disadvantaged or advantaged) backgrounds. It conveys a commitment that female and male students will achieve at comparable levels across all areas. For certain profoundly handicapped students, few if any of these standards will apply. However, the majority of special needs students should have an Individual Education Plan (IEP) which is linked to the curriculum standards. They may address the core curriculum at different levels of depth and may complete the core curriculum according to different timetables. In addition, those students who can do more than achieve this set of expectations must be afforded the opportunity and encouraged to do so.

Insistence on a **core curriculum** means that every student will be involved in experiences addressing all of the expectations of all of the content standards. All schools should have as a common goal that their students will complete this core curriculum, no matter how students are grouped or separated by needs and/or interests. We must provide all students with appropriate challenges so that the raised expectations for all students do not result in lowered expectations for the exceptionally able.

The standards will not result in major improvements unless there is a commitment to their implementation throughout each district and in every school. The staff of each school and at each grade level will have to make decisions about which standards should be their initial focus, and about where to focus their energies in subsequent years. Changing a school's instructional programs to implement the vision of these standards will be a continuous, ongoing process.

District and school administrators will need to create opportunities for teachers to meet together regularly, possibly through the scheduling of common planning times. They should actively encourage teachers in their explorations and provide resources to support such activities. For example, administrators can provide more flexible scheduling, permit extended periods for projects, and schedule contiguous periods for collaboration among teachers from different disciplines. They can also make meaningful professional development for teachers an important priority. In addition, these managers can reach out to corporations, individuals, and groups in the community to provide a variety of learning activities inside and outside of school, including video conferencing and distance learning.

The faculty and other school personnel will need to review and explore together the content and expectations of the standards. They should discuss what each standard and indicator means, the extent to which their educational program matches curricular expectations, and the steps they can take to close the gap, if any, between current student performance and the desired levels of

achievement. In addition, the faculty should explore new teaching strategies in their own classrooms that will result in high achievement by all students, and discuss these results with colleagues. They should also insure that instruction based on the standards provides for continuity and reinforcement of learning from earlier grades, and for content which proceeds to suitable levels of difficulty and abstraction. Other steps the faculty can take include developing their own recommendations for how the school or district can begin to move toward the vision conveyed by the standards. For example, each educator could encourage other members of the school community to hold high expectations for all students.

Local boards of education need to make a concerted effort to provide professional development activities that enable classroom teachers to achieve the goals of this document. Teachers will need to understand and utilize new content material at all grade levels, to participate in orientations on implementation of the cross-content workplace readiness standards, to develop technology skills, and to develop new strategies for helping all students achieve success. One such strategy that is dependent on board initiative is the introduction of technology as a routine tool for teaching and learning. Staff will need both extensive assistance through expanded professional development opportunities, and encouragement from their administration and board of education to take advantage of these opportunities.

Community individuals and organizations must also be active participants in the educational process if the standards are to be achieved. Since business and industry reap the benefits of a quality education, this sector has an important stake in educational outcomes. They should contribute to strengthening the educational program by providing experiences and part-time jobs for students, sharing human resources to extend classroom learning, promoting professional development, and joining partnerships for funding or special activities.

State and local assessments must reflect the nature of the new standards. New Jersey will continue to refine its statewide assessment program to reflect the core curriculum content standards, including both the content standards and the cross-content workplace readiness standards. The eleventh grade High School Proficiency Test (HSPT) and the eighth grade Early Warning Test (EWT) already reflect the higher order skills signaled by the core curriculum content standards. Moreover, the new fourth-grade statewide assessment will embody the new standards and will supersede commercial standardized achievement tests, which tend to reinforce a less challenging curriculum. Since not every indicator, however, can be assessed through a statewide standardized written examination, districts will be involved in measuring the attainment of some performance expectations outlined in the standards.

Conditions Facilitating the Core Curriculum Content Standards

To be effective, schools must continually rethink their processes. Many schools have already adopted team-teaching practices, incorporated cooperative learning, maximized technological

resources, and formed business and industry partnerships. Other schools have further to go on this continuum of success. All schools, however, must continue to raise the expectations for their students. An educational environment which focuses on the use of repetitive and low-level cognitive activities is not appropriate preparation for the demands of the next century. Curricula must contain challenging ideas and tasks applied to real-life, problem-solving activities that stimulate reasoning, foster creativity and an integration of knowledge, and develop evaluative, decision-making skills.

To help students function in a diverse society, the places in which students learn should reflect the heterogeneity of the total school population and of the work world. Schools should set standards for work ethics and human interactions. Such expectations should mirror those which will be demanded of students when they leave the formal learning environment. In addition, the educational setting should reflect the cooperative team approach used by industry, while at the same time allowing for independent thought and growth. Students should also be encouraged to take intellectual risks in an environment which encourages intellectual exploration, creative thinking, and an open exchange of ideas.

Students will apply their core knowledge in a wide range of jobs. They must therefore be allowed to gain and use in a variety of ways the knowledge represented by these core curriculum content standards. No longer should traditional courses provide the only means of learning and reinforcing concepts; schools need to seek out new avenues for learning and for the provision of resources. These avenues will likely include greater interaction with business, industry, local government, and community organizations; volunteer/service activities; and part-time jobs - all coordinated with school learning activities.

Format and Organization

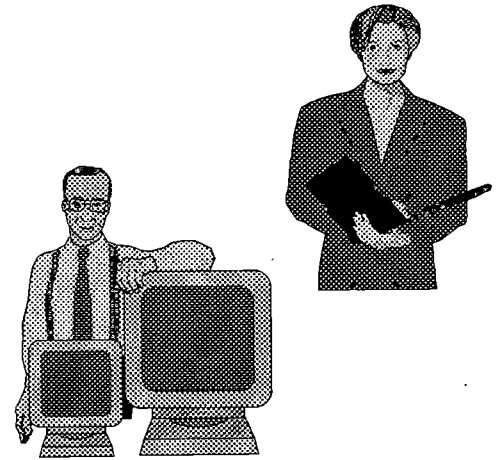
This document begins with a section that sets forth five cross-content workplace readiness standards. Each is elaborated upon in terms of more discrete indicators, but these are not organized by grade cluster. The cross-content workplace readiness section also includes two matrices. The first highlights linkages between the SCANS workplace competencies and foundation skills, and New Jersey's cross-content workplace readiness standards. The second matrix crosscuts these five cross-content workplace readiness standards with specific indicators in each of the seven sections of core curriculum content standards.

The seven content sections are presented in alphabetical order, with each section including an introduction and a list of standards. These are followed by the individual standards, each of which contains a descriptive statement and cumulative progress indicators broken down into what students need to know and be able to do by the end of grades 4, 8, and 11-12.

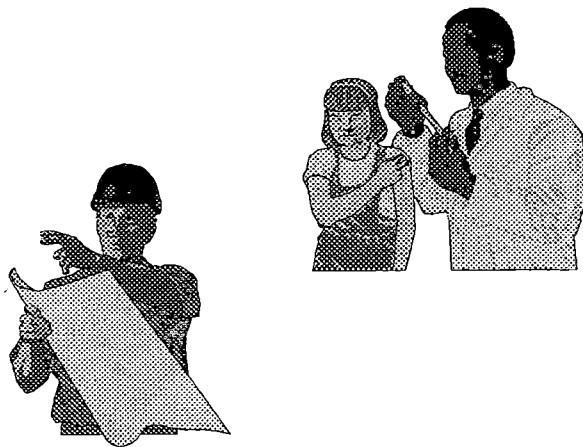
The sequence of the standards is not meant to suggest hierarchical order, or any linear or sequential approach. Rather, the standards are to be construed and applied as integrating aspects of teaching and learning.

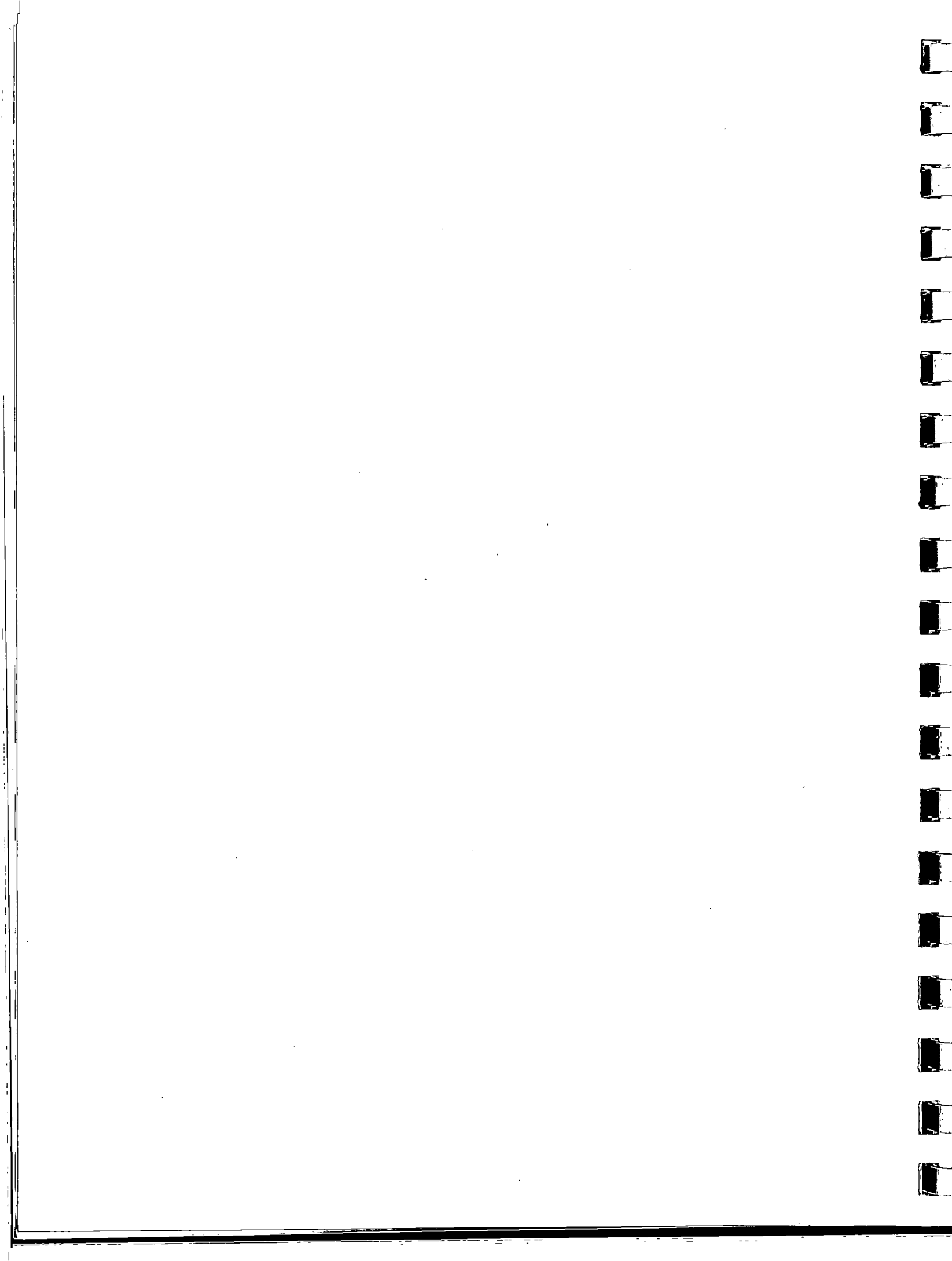
While New Jersey's core curriculum content standards and related indicators have been developed in terms of separate academic disciplines, this familiar approach was chosen primarily for the sake of organizational convenience and simplicity of communication. The results expected of New Jersey students could also have been described in more integrative terms which would have reflected more accurately how students would someday apply what they have learned in school. To focus on the standards primarily in terms of who teaches which discrete piece of knowledge, or which department or certification area is best equipped to teach a particular skill, is not productive.

Students can now obtain knowledge and skill in a multiplicity of ways. Therefore, it is most productive to concentrate on how we can best use resources to achieve higher order results across an array of content areas. Educators will need imagination to blend traditional academic perspectives with the exponentially expanding sources of information and talent available to themselves and their students. The challenge to the educational community, therefore, is to think outside the educational box within which most of us have been schooled.



CROSS-CONTENT WORKPLACE READINESS





CROSS-CONTENT WORKPLACE READINESS STANDARDS

INTRODUCTION

As the content committees met and reviewed the eight subject specific standards (the seven listed areas plus career education), certain themes reoccurred. These common themes reinforce the notion that each content area draws on key elements of other content areas. For example, the need for students to learn problem-solving and critical thinking skills was reflected in all of the sets of standards. Since these cross-content workplace readiness standards are important to the success of all students in all content areas, they have been identified here for special emphasis:

- 1. All students will develop career planning and workplace readiness skills.**
- 2. All students will use technology, information and other tools.**
- 3. All students will use critical thinking, decision-making, and problem-solving skills.**
- 4. All students will demonstrate self-management skills.**
- 5. All students will apply safety principles.**

While the indicators for the cross-content workplace readiness standards are not broken out by grade level, districts should begin building these concepts into their programs at the K-4 level in age appropriate activities, e.g., focusing on positive work habits. Other of the concepts are more appropriate for the higher grade levels, e.g., preparing a resume and completing job applications.

The following is a list of the cross-content workplace readiness standards, with cumulative progress indicators of student skills in each area. Unlike the progress indicators for the seven specific content sections, these indicators are not broken down into grade level clusters because, in addition to crossing all content areas, they also cross all grade levels. Teachers should integrate these concepts into all programs in content-specific and grade-appropriate ways.

Similar concepts have also been identified by members of the business and industry communities as vital. In a 1992 national report, the Secretary's Commission on Achieving Necessary Skills (SCANS) identified several of these concepts as necessary for success in the world of work. The following chart lists the SCANS Workplace Competencies and Foundation Skills referenced with the cross-content workplace readiness standards.

SCANS AND CROSS-CONTENT WORKPLACE READINESS STANDARDS

SCANS WORKPLACE COMPETENCIES Effective workers can productively use:	Cross-Content Standards
Resources -- They know how to allocate time, money, materials, space, and staff.	Demonstrate self-management skills.
Interpersonal skills -- They can work on teams, teach others, serve customers, lead, negotiate, and work well with people from culturally diverse backgrounds.	Demonstrate self-management skills. Develop career planning and workplace readiness skills.
Information -- They can acquire and evaluate data, organize and maintain files, interpret and communicate, and use computers to process information.	Use technology, information and other tools.
Systems -- They understand social, organizational, and technological systems; they can monitor and correct performance; and they can design or improve systems.	Use technology, information and other tools.
Technology -- They can select equipment and tools, apply technology to specific tasks, and maintain and troubleshoot equipment.	Use technology, information and other tools.
SCANS FOUNDATIONS SKILLS Competent workers in the high-performance workplace need:	
Basic Skills -- reading, writing, arithmetic and mathematics, speaking and listening.	The seven sections of core content standards address this area.
Thinking Skills -- the ability to learn, to reason, to think creatively, to make decisions, and to solve problems.	Use critical thinking, decision-making, and problem-solving skills.
Personal Qualities -- individual responsibility, self-esteem and self-management, sociability, integrity, and honesty.	Demonstrate self-management skills. Apply safety principles.

Cross-Content Workplace Readiness Standards Linked with Core Content Areas

In some content areas the total standard addresses one or more of the cross-content workplace readiness standards. However, in other content areas the cross-content workplace readiness standards are addressed within the indicators and their related content.

The following chart provides examples of how the cross-content workplace readiness standards might fit within the content represented by the indicators in the seven core curriculum areas. This chart is not meant to explore all of the possible academic content areas into which the cross-content workplace readiness standards can be incorporated, but is designed simply to demonstrate their interconnectedness.

Cross-Content Workplace Readiness

Cross-Content Workplace Readiness Standards	<i>The Arts (Visual and Performing)</i>	<i>Comprehensive Health and Physical Education</i>	<i>Language Arts Literacy</i>	<i>Mathematics</i>	<i>Science</i>	<i>Social Studies</i>	<i>World Languages</i>
Develop Career Planning and Workplace Readiness Skills	<i>Demonstrate originality, technical skills, and artistic expression in the creation, production and performance of dance, music, theater, or visual arts. 1.2.4</i>	<i>Analyze the causes of conflict and violent behavior in youth and adults, and describe nonviolent strategies for individuals and groups to prevent and resolve conflict. 2.2.10</i>	<i>Understand that written communication can affect the behavior of others. 3.3.15</i>	<i>Apply mathematics in their daily lives and in career-based contexts. 4.3.10</i>	<i>Recognize the role of the scientific community in responding to changing social and political conditions. 5.3.6</i>	<i>Describe work that people perform in our economic system. 6.6.3</i>	<i>Explore employment opportunities where languages are advantageous. 7.1.15</i>
Use Technology, Information and Other Tools	<i>Apply elements and media common to the arts to produce a work of art. 1.3.1</i>	<i>Describe and demonstrate a variety of ways to access and convey health information and ideas. 2.2.1</i>	<i>Take notes on visual information from films, presentations, observations, and other visual media, and report that information through speaking, writing, or their own visual representation 3.5.10</i>	<i>Use technology to gather, analyze and display mathematical data and information. 4.5.5</i>	<i>Use technology to present the design and results of investigation. 5.2.3</i>	<i>Describe the influence of technology in daily life. 6.5.4</i>	<i>Use technology to enhance language acquisition, and to acquire current cultural information, in order to develop more accurate impressions of the culture studied. 7.2.13</i>

Cross-Content Workplace Readiness

Cross-Content Workplace Readiness Standards	<i>The Arts (Visual and Performing)</i>	<i>Comprehensive Health and Physical Education</i>	<i>Language Arts Literacy</i>	<i>Mathematics</i>	<i>Science</i>	<i>Social Studies</i>	<i>World Languages</i>
Use Critical Thinking, Decision-Making, and Problem-Solving Skills	Identify and solve design problems in space, structures, objects, sound, and/or events for home and workplace. 1.6.3	<i>Demonstrate decision-making and refusal skills in situations affecting health and safety. 2.2.2</i>	<i>Analyze text for the purpose, ideas, and style of the author. 3.4.22</i>	<i>Recognize that there may be multiple ways to solve a problem, weigh their relative merits, and select and use appropriate problem-solving strategies. 4.1.13</i>	<i>Compare the advantages and disadvantages of alternative solutions to practical problems. 5.4.9</i>	<i>Compare and contrast divergent interpretations of historical turning points, using available evidence. 6.3.11</i>	<i>Examine interrelationships between the language and the culture of a given group of people, as evidenced in literary works. 7.2.8</i>
Demonstrate Self-Management Skills	Offer constructive critique in the evaluation of their own and others' work in dance, music, theater, or visual arts. 1.4.2	<i>Apply the principles of physiology, kinesiology, and psychology to improve personal performance in physical activity. 2.5.11</i>	<i>Adjust oral communications for different purposes and audiences 3.1.2</i>	<i>Reflect on and clarify their thinking so as to present convincing arguments for their conclusions. 4.2.10</i>	<i>Keep a journal record of observations, recognizing patterns of observations and summarizing findings. 5.2.4</i>	<i>Identify examples of the rights and responsibilities of citizens. 6.1.2</i>	<i>Communicate and interact in a limited range of task-oriented and social situations. 7.1.17</i>

Cross-Content Workplace Readiness

Cross-Content Workplace Readiness Standards	<i>The Arts (Visual and Performing)</i>	<i>Comprehensive Health and Physical Education</i>	<i>Language Arts Literacy</i>	<i>Mathematics</i>	<i>Science</i>	<i>Social Studies</i>	<i>World Languages</i>
Apply Safety Principles	Demonstrate appropriate use of technology, tools, terminology, techniques, and media in the creation of dance, music, theater, or visual arts. 1.3.2	Explain how childhood injuries and illnesses can be prevented and treated. 2.1.4			Design and conduct experiments incorporating the use of a control. 5.2.7	Identify how safety principles are taken into consideration in regards to social, cultural, technological, and economic processes that shape the environment. 6.8.17 6.9.8	

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CROSS-CONTENT WORKPLACE READINESS STANDARDS AND PROGRESS INDICATORS

STANDARD 1	ALL STUDENTS WILL DEVELOP CAREER PLANNING AND WORKPLACE READINESS SKILLS.
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Descriptive Statement: Students will be expected to develop the skills to seek, obtain, maintain, and change jobs. These skills are critical to each student's future ability to navigate in the complex world of work. Prior to leaving school, each student should possess the skills needed to sustain him/herself as an adult in the labor force.

Cumulative Progress Indicators

All students will be able to:

1. Demonstrate employability skills and work habits, such as work ethic, dependability, promptness, and getting along with others, needed to get and keep a job.
2. Describe the importance of personal skills and attitudes to job success.
3. Identify career interests, abilities, and skills.
4. Develop an individual career plan.
5. Identify skills that are transferable from one occupation to another.
6. Select a career major and appropriate accompanying courses.
7. Describe the importance of academic and occupational skills to achievement in the work world.
8. Demonstrate occupational skills developed through structured learning experiences, such as volunteer, community service, and work-based experiences or part-time employment.
9. Identify job openings.
10. Prepare a resume and complete job applications.
11. Demonstrate skills and attitudes necessary for a successful job interview.
12. Demonstrate consumer and other financial skills.

STANDARD 2	ALL STUDENTS WILL USE INFORMATION, TECHNOLOGY, AND OTHER TOOLS.
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Descriptive Statement: Students will be expected to develop skills in the use of information, up-to-date educational technology, and other tools to improve learning, achieve goals, and produce products and presentations. They will learn to develop, locate, summarize, organize, synthesize, and evaluate information. Students will be expected to use technological tools, such as telecommunications networking, for problem-solving, writing, and research.

Cumulative Progress Indicators

All students will be able to:

1. Understand how technological systems function.
2. Select appropriate tools and technology for specific activities.
3. Demonstrate skills needed to effectively access and use technology-based materials through keyboarding, troubleshooting, and retrieving and managing information.
4. Develop, search, and manipulate databases.
5. Access technology-based communication and information systems.
6. Access and assess information on specific topics using both technological (e.g., computer, telephone, satellite) and print resources available in libraries or media centers.
7. Use technology and other tools to solve problems, collect data, and make decisions.
8. Use technology and other tools, including word-processing, spreadsheet and presentation programs, and print or graphic utilities, to produce products.
9. Use technology to present designs and results of investigations.
10. Discuss problems related to the increasing use of technologies.

STANDARD 3	ALL STUDENTS WILL USE CRITICAL THINKING, DECISION-MAKING, AND PROBLEM-SOLVING SKILLS.
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Descriptive Statement: Students will be expected to develop original thoughts and ideas, think creatively, develop habits of inquiry, and take intellectual and performance risks. They will be expected to recognize problems, devise a variety of ways to solve these problems, analyze the potential advantages and disadvantages of each alternative, and evaluate the effectiveness of the method ultimately selected.

Cumulative Progress Indicators

All students will be able to:

1. Recognize and define a problem, or clarify decisions to be made.
2. Use models, relationships, and observations to clarify problems and potential solutions.
3. Formulate questions and hypotheses.
4. Identify and access resources, sources of information, and services in the school and the community.
5. Use the library media center as a critical resource for inquiry and assessment of print and nonprint materials.
6. Plan experiments.
7. Conduct systematic observations.
8. Organize, synthesize, and evaluate information for appropriateness and completeness.
9. Identify patterns and investigate relationships.
10. Monitor and validate their own thinking.
11. Identify and evaluate the validity of alternative solutions.
12. Interpret and analyze data to draw conclusions.
13. Select and apply appropriate solutions to problem-solving and decision-making situations.
14. Evaluate the effectiveness of various solutions.
15. Apply problem-solving skills to original and creative/design projects.

STANDARD 4 ALL STUDENTS WILL DEMONSTRATE SELF-MANAGEMENT SKILLS.
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Descriptive Statement: Students will be expected to address issues related to personal development, such as accepting responsibility for their own learning and understanding expectations for performance. They are also expected to demonstrate positive work behaviors and ethics, the ability to work individually and cooperatively in groups, and respect for others of diverse cultural and social backgrounds.

Cumulative Progress Indicators

All students will be able to:

1. Set short and long term goals.
2. Work cooperatively with others to accomplish a task.
3. Evaluate their own actions and accomplishments.
4. Describe constructive responses to criticism.
5. Provide constructive criticism to others.
6. Describe actions which demonstrate respect for people of different races, ages, religions, ethnicity and gender.
7. Describe the roles people play in groups.
8. Demonstrate refusal skills.
9. Use time efficiently and effectively.
10. Apply study skills to expand their own knowledge and skills.
11. Describe how ability, effort, and achievement are interrelated.

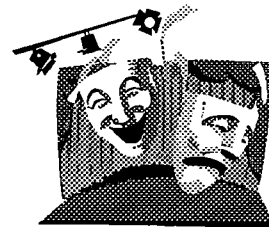
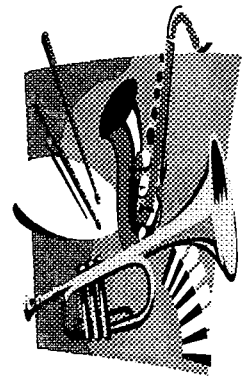
STANDARD 5 ALL STUDENTS WILL APPLY SAFETY PRINCIPLES.

Descriptive Statement: Safety is an important component of all content areas, especially the arts, health and physical education, science, occupational education programs, and any content area where hands-on activities take place. Students need to learn behaviors that will ensure their own safety and health and that of others. They also should become familiar with the rules and laws governing safety and health so that they can act responsibly implement these standards.

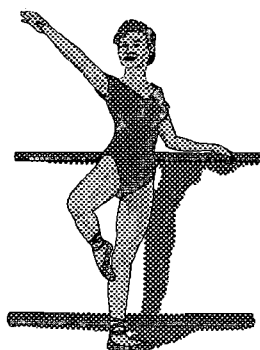
Cumulative Progress Indicators

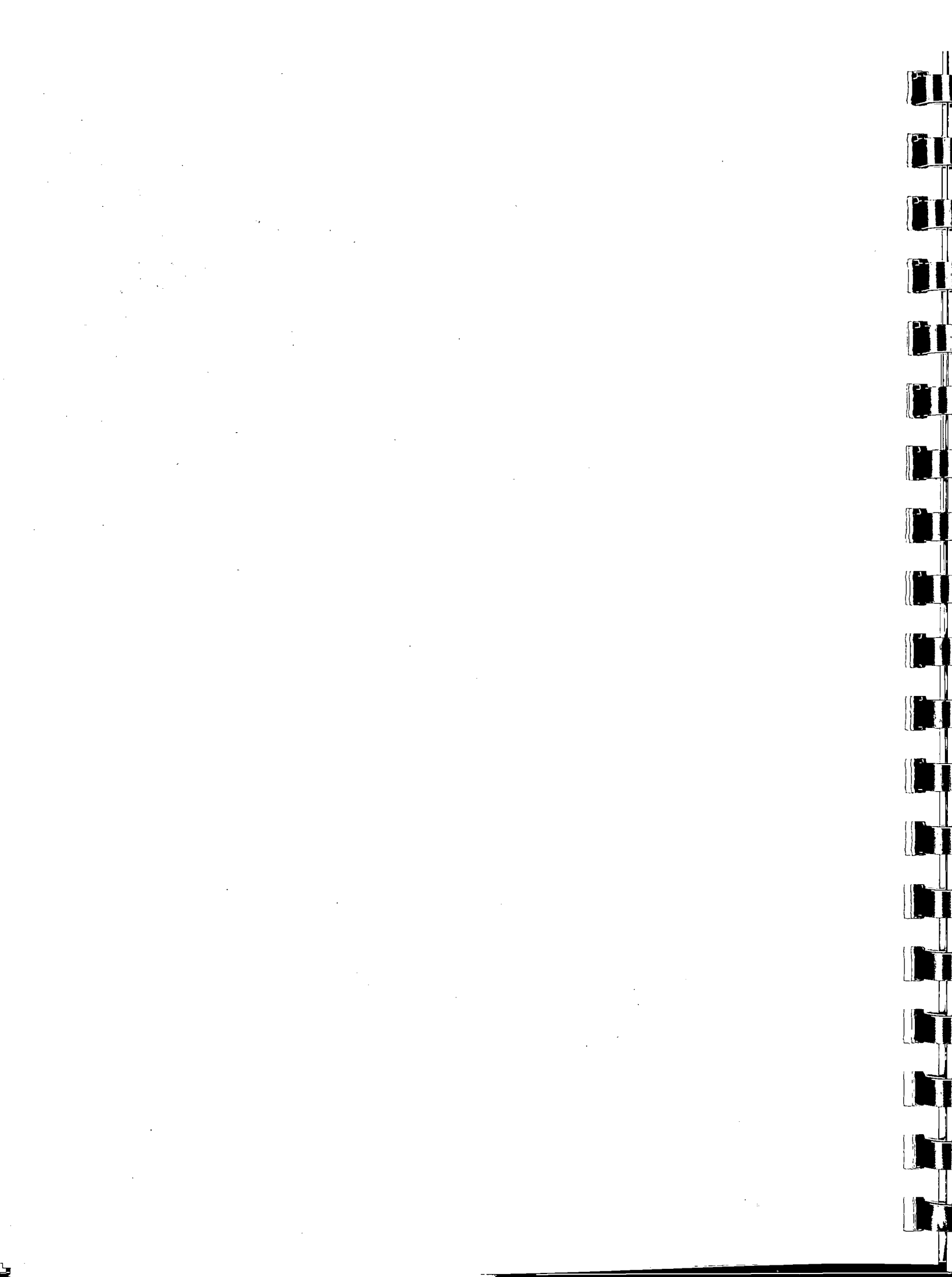
All students will be able to:

1. Explain how common injuries can be prevented.
2. Develop and evaluate an injury prevention program.
3. Demonstrate principles of safe physical movement.
4. Demonstrate safe use of tools and equipment.
5. Identify and demonstrate the use of recommended safety and protective devices.
6. Identify common hazards and describe methods to correct them.
7. Identify and follow safety procedures for laboratory and other hands-on experiences.
8. Discuss rules and laws designed to promote safety and health, and their rationale.
9. Describe and demonstrate procedures for basic first aid and safety precautions.



VISUAL AND PERFORMING ARTS





New Jersey Core Curriculum Content Standards for Visual and Performing Arts

Introduction

An education in the arts is an essential part of the academic curriculum for the achievement of human, social, and economic growth. The education of our students in the disciplines of dance, music, theater, and visual arts is critical to the success of New Jersey and the nation as we move into the twenty-first century. Our economic well-being and ability to compete and cooperate in the global marketplace require that our students learn to develop original ideas, increase their ability to solve problems, and interact in partnerships -- skills inherently learned through the arts.

An education in the arts has the potential to:

Strengthen our ability to be creative and inventive decision-makers;

Develop a wide range of skills significant to many aspects of life and work;

Provide varied and powerful ways of communicating ideas, thoughts and feelings, both as individuals and as members of communities;

Enable us to understand and influence the increasingly complex technological environment affecting all aspects of our lives;

Provide a strong economic base through the state's cultural attractions;

Emphasize humanities education as a key to understanding the arts as products of complex social, cultural, and intellectual trends;

Enrich understanding of the human experience across cultures and histories, including the accomplishments of men and women of different ethnic, racial, and cultural backgrounds;

Provide valuable tools to enhance learning across all disciplines, and

Empower people to create, reshape and fully participate in personal and community environments, to enhance the quality of life for all.

All children require and must be provided with an opportunity for a meaningful arts education. These core curriculum standards provide the foundation for creating a framework for essential arts education in all New Jersey schools. They form the core of our expectations for New Jersey students.

Six core curriculum content standards for Visual and Performing Arts are arranged in five broad categories including: aesthetic (1.1); creating and performing (1.2, 1.3); critical, analytic, judgmental, and evaluative (1.4); historical, social, and cultural (1.5); and design with respect to form, function, and structure (1.6).

The categories stated above include specific standards that define these artistic concepts and elements in the art forms of dance, music, theater, and the visual arts. A focus on general artistic concepts and themes rather than on the individual art forms provides a document that can be easily accessed by all arts educators, regardless of discipline.

While national, state, and individual arts discipline standards were extensively reviewed and considered during initial panel deliberation, it was determined that a more comprehensive and interdisciplinary design be constructed, where all art forms could be included in one document. These standards reflect the concern that the separate arts disciplines be viewed as one common body of skills and knowledge.

**VISUAL AND PERFORMING ARTS
LIST OF STANDARDS**

- 1.1 All students will acquire knowledge and skills that increase aesthetic awareness in dance, music, theater, and visual arts.
- 1.2 All students will refine perceptual, intellectual, physical, and technical skills through creating dance, music, theater, and/or visual arts.
- 1.3 All students will utilize arts elements and arts media to produce artistic products and performances.
- 1.4 All students will demonstrate knowledge of the process of critique.
- 1.5 All students will identify the various historical, social, and cultural influences and traditions which have generated artistic accomplishments throughout the ages and which continue to shape contemporary arts.
- 1.6 All students will develop design skills for planning the form and function of space, structures, objects, sound, and events.

**VISUAL AND PERFORMING ARTS
STANDARDS AND PROGRESS INDICATORS**

**STANDARD 1.1 ALL STUDENTS WILL ACQUIRE KNOWLEDGE AND SKILLS
THAT INCREASE AESTHETIC AWARENESS IN DANCE,
MUSIC, THEATER, AND VISUAL ARTS.**

Descriptive Statement: The arts strengthen our appreciation of the world as well as our ability to be creative and inventive decision-makers. The acquisition of knowledge and skills that contribute to aesthetic awareness of dance, music, theater, and the visual arts enhances these abilities.

Cumulative Progress Indicators

By the end of **Grade 4**, students:

1. Communicate their responses to dance, music, theater, and visual arts with supporting statements based on aesthetics.

Building upon knowledge and skills gained in the preceding grades, by the end of **Grade 8**, students:

2. Understand that arts elements, such as color, line, rhythm, space, form, may be combined selectively to elicit a specific aesthetic response.
3. Communicate about the aesthetic qualities of art works through oral and written analysis using appropriate technical and evaluative terms.

Building upon knowledge and skills gained in the preceding grades, by the end of **Grade 12**, students:

4. Demonstrate an understanding of different aesthetic philosophies through the evaluation and analysis of artistic styles, trends, and movements in an art form.

STANDARD 1.2 ALL STUDENTS WILL REFINE PERCEPTUAL, PHYSICAL, AND TECHNICAL SKILLS THROUGH CREATING DANCE, MUSIC, THEATER, AND/OR VISUAL ARTS.

Descriptive Statement: Through an education in the arts, students enhance their perceptual, physical, and technical skills and learn that pertinent techniques and technologies apply to the successful completion of tasks. The development of sensory acuity (perceptual skills) enables students to perceive and acknowledge various viewpoints. Appropriate physical movements, dexterity, and rhythm pertain to such activities as brush strokes in painting, dance movement, fingering of musical instruments, etc.

Cumulative Progress Indicators

By the end of **Grade 4**, students:

1. Demonstrate performance and participation skills by working and creating individually and with others.

Building upon knowledge and skills gained in the preceding grades, by the end of **Grade 8**, students:

2. Demonstrate technical skills in dance, music, theater, or visual arts, appropriate to students' developmental level.
3. Create, produce, or perform works of dance, music, theater, or visual arts, individually and with others.

Building upon knowledge and skills gained in the preceding grades, by the end of **Grade 12**, students:

4. Demonstrate originality, technical skills, and artistic expression in the creation, production, and performance of dance, music, theater, or visual arts.

STANDARD 1.3	ALL STUDENTS WILL UTILIZE ARTS ELEMENTS AND ARTS MEDIA TO PRODUCE ARTISTIC PRODUCTS AND PERFORMANCES.
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Descriptive Statement: In order to understand the arts, students must discover the common elements and properties of dance, music, theater, and visual arts. These arts elements, such as color, line, form, rhythm, space, timing, movement, mood, etc., are the ingredients from which works of art are made.

Cumulative Progress Indicators

By the end of **Grade 4**, students:

1. Apply elements and media common to the arts to produce a work of art.

Building upon knowledge and skills gained in the preceding grades, by the end of **Grade 8**, students:

2. Demonstrate appropriate use of technology, tools, terminology, techniques, and media in the creation of dance, music, theater, or visual arts.

Building upon knowledge and skills gained in the preceding grades, by the end of **Grade 12**, students:

3. Demonstrate an understanding of technology, methods, materials, and creative processes commonly used in dance, music, theater, or visual arts.

STANDARD 1.4 ALL STUDENTS WILL DEMONSTRATE KNOWLEDGE OF THE PROCESS OF CRITIQUE.

Descriptive Statement: Art criticism assists in the development of critical thinking skills of observation, description, analysis, interpretation, and evaluation. Students engage in and evaluate multisensory learning experiences as both participants and observers. The process of critique helps students to develop a sense of aesthetics and leads to artistic and personal growth.

Cumulative Progress Indicators

At all grade levels, students:

1. Explain the criteria by which they evaluate the quality of their work and the work of others.

Building upon knowledge and skills gained in the preceding grades, by the end of **Grade 8** students:

2. Offer constructive critique in the evaluation of their own and others' work in dance, music, theater, or visual arts.

Building upon knowledge and skills gained in the preceding grades, by the end of **Grade 12**, students:

3. Evaluate and interpret works of art orally and in writing, using appropriate terminology.

STANDARD 1.5	ALL STUDENTS WILL IDENTIFY THE VARIOUS HISTORICAL, SOCIAL, AND CULTURAL INFLUENCES AND TRADITIONS WHICH HAVE GENERATED ARTISTIC ACCOMPLISHMENTS THROUGHOUT THE AGES, AND WHICH CONTINUE TO SHAPE CONTEMPORARY ARTS.
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Descriptive Statement: The history of the world is told through the arts. By being able to identify historical, social, and cultural influences related to the arts, students will have a better and more complete understanding of humankind past, present, and future and of the arts as forms of human expression.

Cumulative Progress Indicators

By the end of **Grade 4**, students:

1. Investigate, experience and participate in dance, music, theater, and visual arts activities representing various historical periods and world cultures.
2. Investigate and experience the works of artists and community cultural resources through exhibitions and performances.
3. Apply knowledge of historical, social, and cultural influences to understanding a work of art.
4. Use their senses, imagination, and memory to express ideas and feelings in dance, music, theater and visual arts.

Building upon knowledge and skills gained in the preceding grades, by the end of **Grade 8**, students:

5. Identify significant artists and artistic works in dance, music, theater, and visual arts representing various historical periods, world cultures, and social and political influences.
6. Understand and demonstrate a knowledge of how various artists and cultural resources preserve our cultural heritage and influence contemporary arts.
7. Interpret the meaning(s) expressed in works of dance, music, theater, and visual arts.

Building upon knowledge and skills gained in the preceding grades, by the end of **Grade 12**, students:

8. Demonstrate knowledge of how artists and artistic works connect with political, social, cultural, and historical events.
9. Analyze and evaluate how various artists and cultural resources influence student work.
10. Create works of art that communicate personal opinions, thoughts, and ideas.

STANDARD 1.6	ALL STUDENTS WILL DEVELOP DESIGN SKILLS FOR PLANNING THE FORM AND FUNCTION OF SPACE, STRUCTURES, OBJECTS, SOUND, AND EVENTS.
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Descriptive Statement: The development of knowledge and skills in design produces the power to create or to enhance the economy and the quality of life. All inventions, everything made by human hands, require design skills: fabric and clothing, landscapes and interiors, residential and corporate architecture, product and package design, video and print graphics. Neighborhood and city planning can be aesthetically improved with skills in the design of space and form. Staging is essential to the planning of successful events, whether personal, business or community. Elements of design affect nearly all aspects of daily living.

Cumulative Progress Indicators

By the end of **Grade 4**, students:

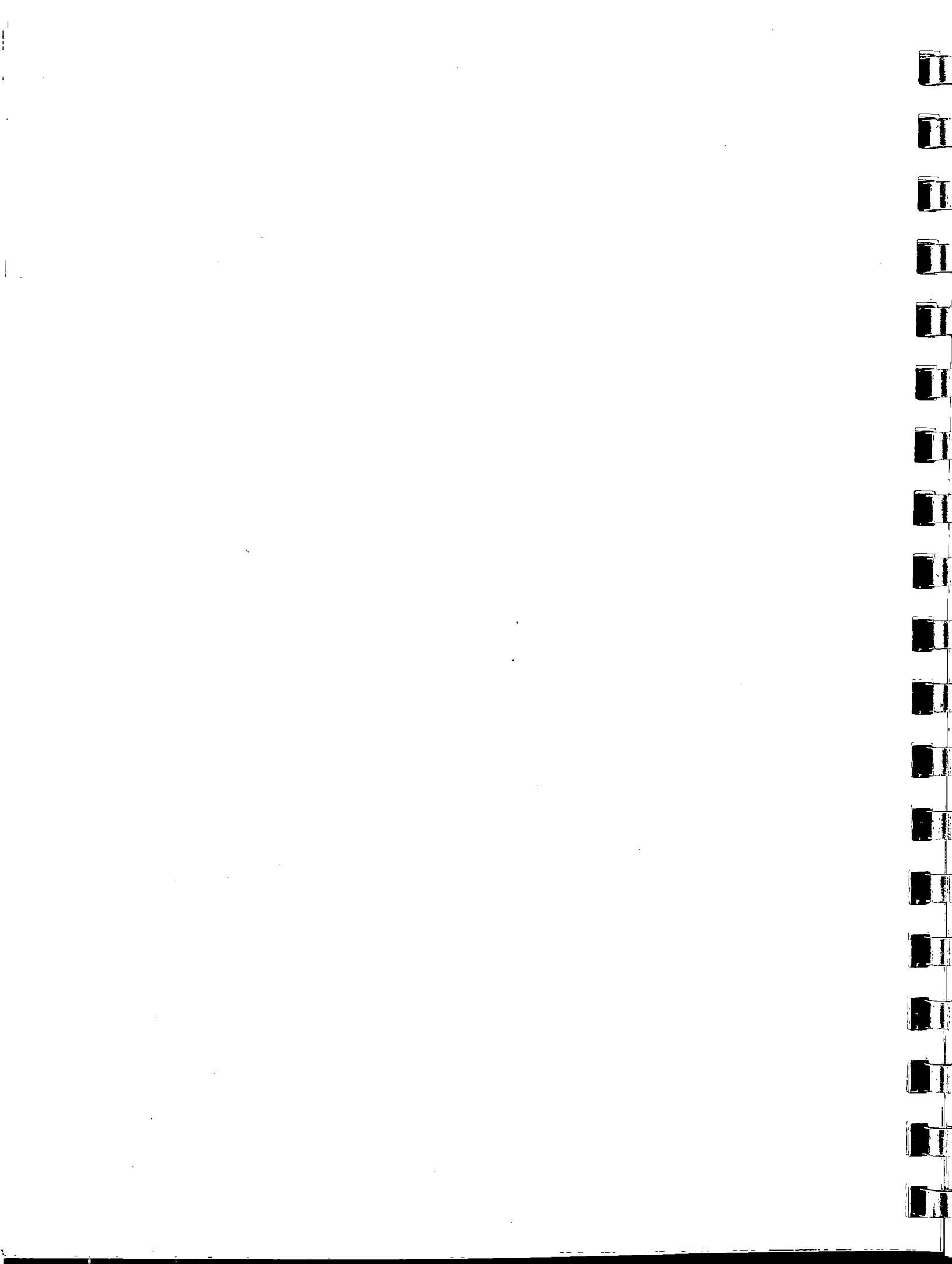
1. Identify and state needs and opportunities for design in the contexts of home, school, recreation, and play.
2. Plan and execute solutions to design problems.

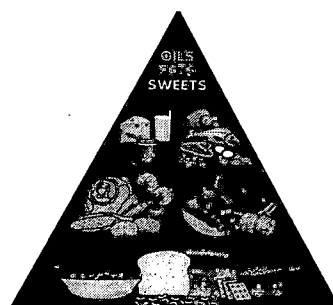
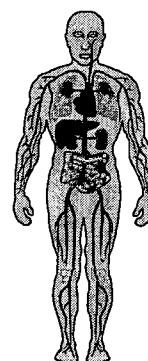
Building upon knowledge and skills gained in the preceding grades, by the end of **Grade 8**, students:

3. Identify and solve design problems in space, structures, objects, sound, and/or events for home and workplace.

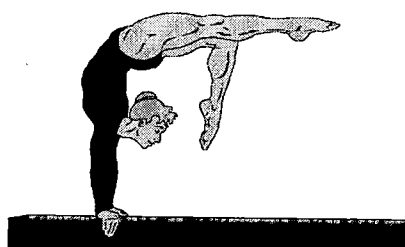
Building upon knowledge and skills gained in the preceding grades, by the end of **Grade 12**, students:

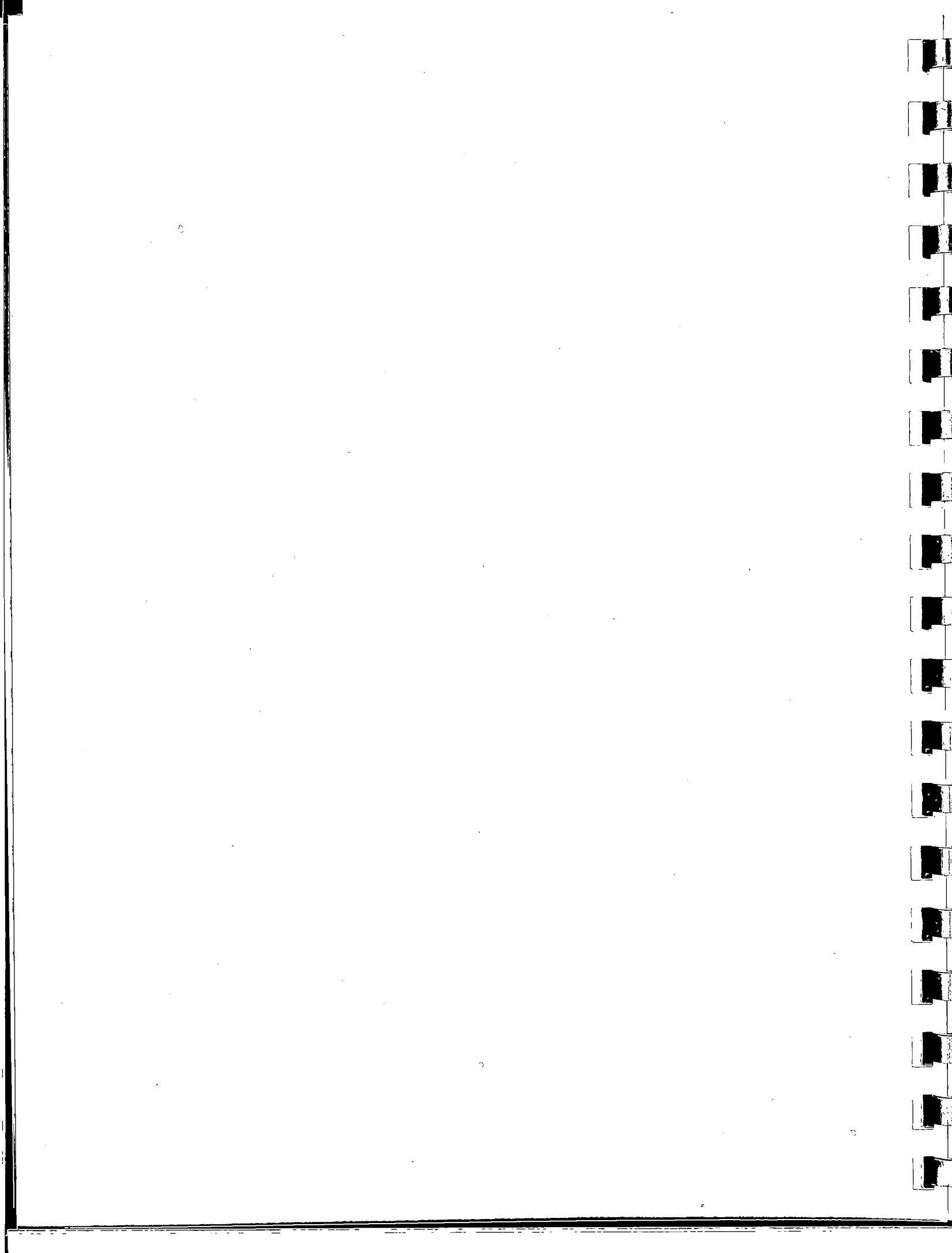
4. Identify, plan, and provide solutions to design problems of space, structures, objects, sound, and/or events in a public or private environment.





COMPREHENSIVE HEALTH and PHYSICAL EDUCATION





New Jersey Core Curriculum Content Standards for Comprehensive Health and Physical Education

Introduction

Public schools have a responsibility to give children in the community the knowledge and skills necessary for successful living. Comprehensive health and physical education programs encourage students to take responsibility for their own lives by acting conscientiously in the present and by establishing positive health practices that will support and enhance lifelong wellness. The goal of the comprehensive health and physical education program is to develop citizens who are both **health-literate and physically educated**. **Health literacy** is defined as the capacity of individuals to obtain, interpret, and understand basic health information and services, and the competence to use such information and services in ways which enhance health (Joint Committee on National Health Education Standards, 1995). Citizens who are **physically educated** exhibit a physically active lifestyle, can perform a variety of physical activities, and understand the benefits of involvement in physical activity (National Association for Sport and Physical Education, 1995).

Citizens who are health-literate and physically educated have the knowledge and skills to better achieve and maintain physical, social, and emotional health. These individuals are better able to contribute to the nation's economic competitiveness by working more effectively, by missing fewer days from work due to illness or injury, by using fewer medical services due to the prevention or delayed onset of health problems, and by reducing the use and cost of health insurance benefits (Joint Committee, 1995). The knowledge and skills gained from comprehensive health and physical education contribute to a better quality of life for the individual, the family, and the community.

To prepare students for the next century, comprehensive health and physical education programs must focus on the needs of students. Serious health problems and violence confront our young people on a daily basis, while conflicting messages from the adult world facilitate and even encourage high-risk behavior. The major health problems facing our nation today are, in large

part, attributable to behaviors adopted during childhood and adolescence (U. S. Department of Health and Human Services, 1991). From 1989 to 1992, over twenty-five major studies and reports addressed the health and educational needs of our youth, with the following major findings:

Education and health are interrelated. Health problems that afflict students erode both their health status and their educational achievement, limiting their potential as productive members of the workforce.

The greatest threats to health are "social morbidities." Many health problems which are largely preventable are influenced by specific behaviors and practices established during youth and continuing into adulthood (Kolbe, 1990; Kann, 1993).

Prevention efforts are cost-effective, while the social and economic costs of inaction are intolerable. Failure in school, underachievement, and related health problems have serious repercussions for students, their families, and ultimately, the economic health of the nation (Harvard School of Public Health, 1992).

The standards for comprehensive health and physical education emphasize those health problems most often identified in research. Studies indicate six primary causes of our major health problems:

1. Behaviors that cause intentional and unintentional injuries
2. Drug and alcohol use
3. Tobacco use
4. Sexual behaviors that lead to sexually transmitted diseases, including HIV infection, and unintended pregnancy
5. Inadequate physical activity
6. Dietary patterns that cause disease

Each of these areas is addressed by the core curriculum content standards for Comprehensive Health and Physical Education.

These standards link the efforts of the student, the family, the school, and the community to focus on behaviors that interfere with health and learning. The standards are an integral part of the core education program that considers the whole child, including his or her intellectual capacity, physical and emotional health, and social adjustment. Both physical education and health standards emphasize life-long participation in physical activities, learning to play by the rules, and good sportsmanship. The standards provide information and skills to develop responsible citizens who are both health-literate and physically educated.

The standards in this section lay the groundwork for local school districts to develop a comprehensive health and physical education program that challenges all students. In developing its family life education curriculum, local school districts should continue to consult with the community as required by current regulations. If however, a parent or guardian feels that the content of the family life standard is in conflict with sincerely held moral or religious beliefs then, pursuant to N.J.A.C. 6:29-4, 2 (j), the pupil may be exempted from that part of the instructional program. Focusing on behaviors that interfere with lifelong learning and long-term wellness, the standards specify the essential knowledge and skills needed to address those significant health problems that impede the health, fitness and productivity of our citizens.

It is the growing belief that any future advances made in improving the nation's health will not result from spectacular biomedical breakthroughs. Rather, advances will result from personally initiated actions that are directly influenced by the individual's health-related attitudes, beliefs, and knowledge.

American Medical Association

In the great work of education, our physical condition, if not the first step in point of importance, is the first in order of time. On the broad and firm foundation of health alone can the loftiest and most enduring structures of the intellect be reared.

Horace Mann

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**COMPREHENSIVE HEALTH AND PHYSICAL EDUCATION
LIST OF STANDARDS**

- 2.1 All students will learn health promotion and disease prevention concepts and health-enhancing behaviors.
- 2.2 All students will learn health-enhancing personal, interpersonal, and life skills.
- 2.3 All students will learn the physical, mental, emotional, and social effects of the use and abuse of alcohol, tobacco, and other drugs.
- 2.4 All students will learn the biological, social, cultural, and psychological aspects of human sexuality and family life.
- 2.5 All students will learn and apply movement concepts and skills that foster participation in physical activities throughout life.
- 2.6 All students will learn and apply health-related fitness concepts.

COMPREHENSIVE HEALTH AND PHYSICAL EDUCATION STANDARDS AND PROGRESS INDICATORS

STANDARD 2.1	ALL STUDENTS WILL LEARN HEALTH PROMOTION AND DISEASE PREVENTION CONCEPTS AND HEALTH-ENHANCING BEHAVIORS.
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Descriptive Statement: Health-literate and physically educated students seek to improve personal, family, and public health. Using health promotion and disease prevention principles, nutritional concepts, and injury prevention strategies, students modify personal behaviors based on risk factors and adopt health practices to reduce or eliminate preventable health problems. Health-literate and physically educated students recognize the importance of prevention, early detection, and treatment in enhancing personal wellness.

Cumulative Progress Indicators

By the end of **Grade 4**, students:

1. Describe a healthy child and identify factors that contribute to good health.
2. Describe the basic structure and function of human body systems.
3. Identify and demonstrate responsible health behaviors for children.
4. Explain how childhood injuries and illnesses can be prevented and treated.
5. Describe potentially dangerous or threatening situations related to childhood activities, develop personal protection strategies, and cite resources for help.
6. Identify common health products and foods found in the home and correctly interpret labels, information, directions, and warnings.

Building upon knowledge and skills gained in the preceding grades, by the end of **Grade 8**, students:

7. Describe a healthy adolescent, discuss injuries and illnesses common to this age group, and identify ways to prevent, reduce, or eliminate these health problems.
8. Explain how health is influenced by the interaction of body systems and nutritional intake.
9. Analyze how family, peers, culture, media, technology, and the environment affect wellness.
10. Identify and demonstrate health practices that support and enhance personal and family physical and mental health.
11. Analyze a health profile to determine strengths and potential health risks resulting from risk factors and health-enhancing behaviors.
12. Describe situations requiring health services and locate community health care providers, comparing their services, benefits, and costs.
13. Examine health product and food labels and advertisements, comparing accuracy, content, directions, and value.
14. Analyze the influence of peers and the media on risk behaviors, injuries, and violent behavior.

Building upon knowledge and skills gained in the preceding grades, by the end of **Grade 12**, students:

15. Describe a healthy adult, discuss adult physical and mental health problems, and use health assessment data to develop strategies for reducing health problems and related risk factors.
16. Analyze the impact of genetic, nutritional, behavioral, cultural, and environmental factors on the functioning of body systems and use this information to identify responsible health practices.
17. Analyze situations that require professional health services, analyze the costs and sources of payment, and discuss how these factors influence the accessibility and delivery of health care.
18. Discuss and compare the influence of public health policy, government regulations, research, medical advances, and the health care industry on current and emerging health problems.
19. Describe the principles of injury prevention and risk management, analyze factors that contribute to the incidence of injuries and violence, and develop strategies for prevention.
20. Analyze the influence of the media on risk behaviors, disease prevention, and the incidence of injuries and violent behavior.

STANDARD 2.2 ALL STUDENTS WILL LEARN HEALTH-ENHANCING PERSONAL, INTERPERSONAL, AND LIFE SKILLS.

Descriptive Statement: Health-literate and physically educated students communicate effectively. These students set health goals, solve health-related problems, and resolve conflicts. They use health-enhancing personal, interpersonal, and life skills to initiate and maintain healthy relationships that contribute to wellness.

Cumulative Progress Indicators

By the end of Grade 4, students:

1. Describe and demonstrate a variety of ways to access and convey health information and ideas.
2. Demonstrate decision-making and refusal skills in situations affecting health and safety.
3. Define health goals, differentiate between long and short term goals, and set a personal health goal to track progress.
4. Define conflict and demonstrate appropriate nonviolent strategies to resolve it.
5. Describe how culture and the media affect the ways individuals communicate, show emotions, and cope with stress.

Building upon knowledge and skills gained in the preceding grades, by the end of Grade 8, students:

6. Describe and demonstrate ways to access and present health information and ideas, and analyze the information for accuracy and reliability.
7. Describe and demonstrate effective communication skills, decision-making skills, refusal skills, negotiation skills, and assertiveness in situations that influence adolescent health and safety.
8. Analyze how health decisions and behaviors are influenced by family, peers, culture, and the media, and develop strategies that support effective decision-making and safe behavior.
9. Describe how health goals are influenced by changes that occur throughout the life cycle.
10. Analyze the causes of conflict and violent behavior in youth and adults, and describe nonviolent strategies for individuals and groups to prevent and resolve conflict.
11. Describe the impact of crisis, stress, rejection, separation, and loss, and develop coping strategies for each.

Building upon knowledge and skills gained in the preceding grades, by the end of **Grade 12**, students:

12. Synthesize, interpret, and express information about health issues using valid resources, and adapt the information for different audiences.
13. Analyze social situations and conditions that affect health and safety, and select and evaluate the appropriate skills for each situation.
14. Analyze the causes of conflict in groups, families, and within the community, and demonstrate and evaluate nonviolent strategies to prevent, mediate, and resolve conflict.
15. Analyze the impact of crisis, stress, rejection, separation, and loss on physical and emotional health, and develop coping strategies that consider the influence of family, culture, and personal experiences.
16. Develop a plan for lifelong wellness using data from health assessments, family history, nutritional information, and current health practices, and evaluate progress towards meeting health goals in the plan.
17. Predict adult daily needs to maintain a healthy lifestyle, design a plan and budget based on those needs, and justify the plan.

STANDARD 2.3	ALL STUDENTS WILL LEARN THE PHYSICAL, MENTAL, EMOTIONAL, AND SOCIAL EFFECTS OF THE USE AND ABUSE OF ALCOHOL, TOBACCO, AND OTHER DRUGS.
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Descriptive Statement: Health-literate and physically educated students know the short and long term effects of alcohol, tobacco, and other drugs on the body, behavior, performance, and personal relationships. These students use medicines correctly and refrain from the harmful or illicit use of chemical substances. Health-literate and physically educated students identify and use resources for information about chemical dependency, and know how to seek support, assistance, and treatment for problems associated with the abuse of alcohol, tobacco, and other drugs.

Cumulative Progress Indicators

By the end of Grade 4, students:

1. Define drugs and medicines, describe the purposes and correct use of medicines, and describe the role they play in the maintenance or achievement of wellness.
2. Recognize the physical and behavioral effects of alcohol, marijuana, tobacco products, inhalants, anabolic steroids, and household substances that may be misused for mood-altering effects.
3. Recognize the signs and symptoms of chemical misuse, abuse and dependency, discuss their impact on personal and family health, and identify resources for help and information.
4. Identify laws related to the sale and use of alcohol, tobacco, and other drugs.
5. Describe how the use, misuse and abuse of alcohol, tobacco, and other drugs contribute to the incidence of illness and injury.

Building upon knowledge and skills gained in the preceding grades, by the end of Grade 8, students:

6. Classify chemical substances by their actions on the body, and describe the short and long term effects of their use.
7. Discuss the appropriate use of medicines and the dangers of drug interactions.
8. Analyze the impact of chemical substances on development, behavior, and activities.
9. Describe the signs and progression of chemical use, abuse, and dependency throughout the life cycle.
10. Identify and explain how to access resources for information, support, and treatment of problems related to the use and abuse of chemical substances.
11. Discuss laws pertaining to the use, sale, and possession of alcohol, tobacco, and other drugs.

Building upon knowledge and skills gained in the preceding grades, by the end of **Grade 12**, students:

12. Discuss chemical substances according to their uses, actions, and effects on the body.
13. Discuss the influence of the media on the choice, use, and misuse of medicines.
14. Discuss alternative actions for relief or treatment of common health problems.
15. Analyze the short and long term effects of chemical use, abuse, and dependency on the body, behavior, work and school performance, and personal relationships.
16. Describe intervention and treatment strategies for chemically dependent individuals, and locate community resources for information, support, and treatment.
17. Interpret laws pertaining to the use, sale, and possession of chemical substances, with an emphasis on laws relating to driving under the influence.
18. Describe how chemical substances used during pregnancy can affect prenatal and early childhood growth and development.

STANDARD 2.4	ALL STUDENTS WILL LEARN THE BIOLOGICAL, SOCIAL, CULTURAL, AND PSYCHOLOGICAL ASPECTS OF HUMAN SEXUALITY AND FAMILY LIFE.
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Descriptive Statement: Health-literate and physically educated students consider the biological, social, psychological, and cultural implications of sexual behavior when making health-enhancing choices. Health-literate and physically educated individuals take personal responsibility for their sexual health and the health of their relationships, and recognize the impact that sexual decisions may have on the well-being of others.

Cumulative Progress Indicators

By the end of **Grade 4**, students:

1. Identify the stages of human development from conception to death.
2. Identify ways to show affection and caring that are appropriate for children.
3. Discuss how family and friends are important throughout life and that relationships require respect for others.
4. Explain different kinds of families and that all family members have rights, privileges, and responsibilities.
5. Discuss the influence of the media on the development of gender stereotypes.

Building upon knowledge and skills gained in the preceding grades, by the end of **Grade 8**, students:

6. Describe the significant developmental milestones of each stage of human development, with emphasis on the physical, emotional, and social changes of adolescence.
7. Describe the functioning of the human reproductive system and the physical and emotional changes that occur at puberty.
8. Describe and discuss affection, love, commitment, and sexual attraction, and the difference between having sexual feelings and acting on them.
9. Discuss factors that support and sustain relationships such as friendships and marriage.
10. Describe the responsibilities of parenthood, with an emphasis on teen parenthood, and discuss the impact of parenthood on parents, family members, and the child.
11. Discuss the impact of early sexual activity on physical, emotional, and social health.
12. Develop strategies to support sexual abstinence, and compare and contrast methods of contraception used to reduce the risk of sexually transmitted diseases, HIV and unintended pregnancy.

13. Analyze sexual messages, images, and stereotypes presented in the media and discuss their impact on sexual behavior.

Building upon knowledge and skills gained in the preceding grades, by the end of **Grade 12**, students:

14. Discuss theoretical models of human personality development.
15. Describe the physical, emotional, and social changes that occur at each stage of human development, and the role of human sexuality throughout the life cycle.
16. Describe how personal relationships evolve over time, focusing on changes in friendships, family, dating relationships, and marriage.
17. Analyze the responsibilities, joys, demands, and challenges of parenthood.
18. Describe safe and effective parenting skills, and identify resources for information and help with parenting.
19. Discuss issues regarding sexual orientation, sexual harassment, sexual assault, and domestic violence.
20. Compare and contrast risk reduction and prevention strategies, including sexual abstinence, monogamy, and methods of contraception.
21. Identify resources that provide information, assistance, and care in addressing sexual and reproductive health and legal issues.

STANDARD 2.5 ALL STUDENTS WILL LEARN AND APPLY MOVEMENT CONCEPTS AND SKILLS THAT FOSTER PARTICIPATION IN PHYSICAL ACTIVITIES THROUGHOUT LIFE.

Descriptive Statement: Health-literate and physically educated students understand movement concepts and principles and apply them as they practice, assess, and refine movement skills in a variety of physical activities including games, sports, and lifetime recreational pursuits. Knowledge of movement concepts and practice of skills enhance the likelihood of independent learning and participation in physical activity throughout life.

Cumulative Progress Indicators

By the end of Grade 4, students:

1. Perform locomotor (walk, run, jump), non-locomotor (bend, reach, turn), and manipulative (throw, strike, kick) movement skills.
2. Modify basic movement skills by applying movement concepts (direction, speed), biomechanical principles (force, projection), and rhythm (tempo, beat).
3. Adapt movement skills in relation to objects, other participants, and boundaries.
4. Combine movement skills to participate in physical activities, such as games, sports, and lifetime recreational pursuits.
5. Describe when, where, and how to use and adapt specific movement skills and concepts in physical activities.
6. Observe physical activities and provide feedback to participants to improve performance.

Building upon knowledge and skills gained in the preceding grades, by the end of Grade 8, students:

7. Describe the characteristics of skilled performance in a variety of physical activities.
8. Modify and combine movement skills using movement concepts, biomechanical principles, and rhythm to improve performance in physical activities.
9. Describe and demonstrate the application of appropriate rules, strategies, and sportsmanship behaviors as a participant in and observer of physical activities.

Building upon knowledge and skills gained in the preceding grades, by the end of **Grade 12**, students:

10. Analyze and apply movement concepts, biomechanical principles, and rhythm to independently learn, assess, refine, and combine movement skills used in physical activities.
11. Apply the principles of physiology, kinesiology, and psychology to improve personal performance in physical activity.

STANDARD 2.6	ALL STUDENTS WILL LEARN AND APPLY HEALTH-RELATED FITNESS CONCEPTS.
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Descriptive Statement: Health-literate and physically educated students know the components of health-related fitness: cardiorespiratory endurance, muscular strength/endurance, flexibility, and body composition. Considering these components, students are able to meet their personal fitness needs by monitoring and adapting physical activity levels. Health-literate and physically educated students recognize that lifetime fitness activities contribute to wellness.

Cumulative Progress Indicators

By the end of **Grade 4**, students:

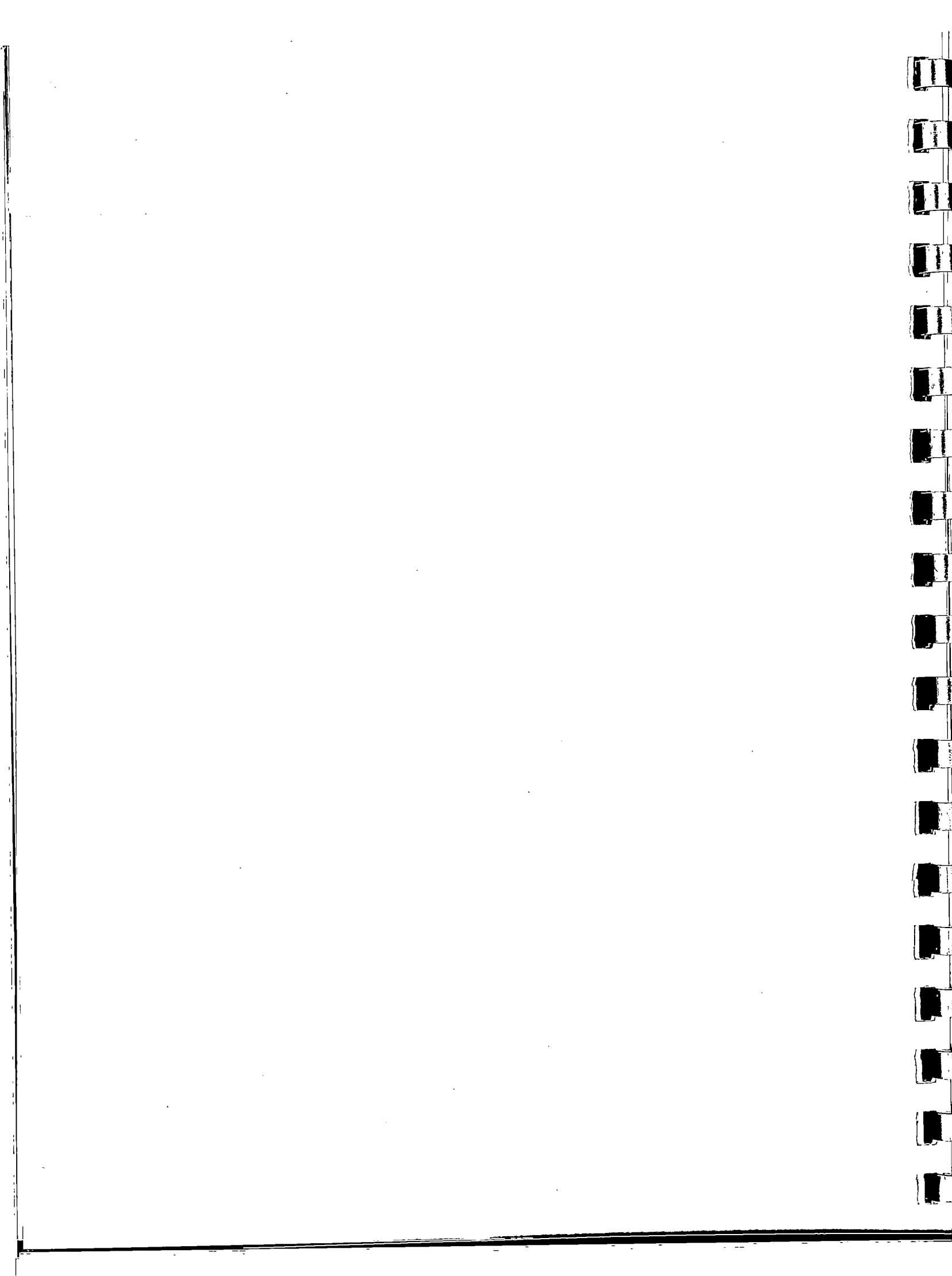
1. Identify the components of health-related fitness and describe activities related to each component.
2. Demonstrate appropriate techniques used in fitness activities.
3. Describe how fitness activities enhance wellness.
4. Participate in health-related fitness activities.
5. Develop and attain a personal fitness goal to improve performance.

Building upon knowledge and skills gained in the preceding grades, by the end of **Grade 8**, students:

6. Describe the components of health-related fitness and how each contributes to wellness.
7. Discuss and apply basic principles of training to fitness activities.
8. Assess physiological indicators of exercise before, during, and after physical activity, and describe how these can be used to monitor and improve performance.
9. Develop a personal fitness plan, using data from health assessments and fitness testing.

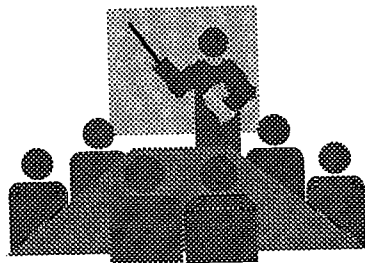
Building upon knowledge and skills gained in the preceding grades, by the end of **Grade 12**, students:

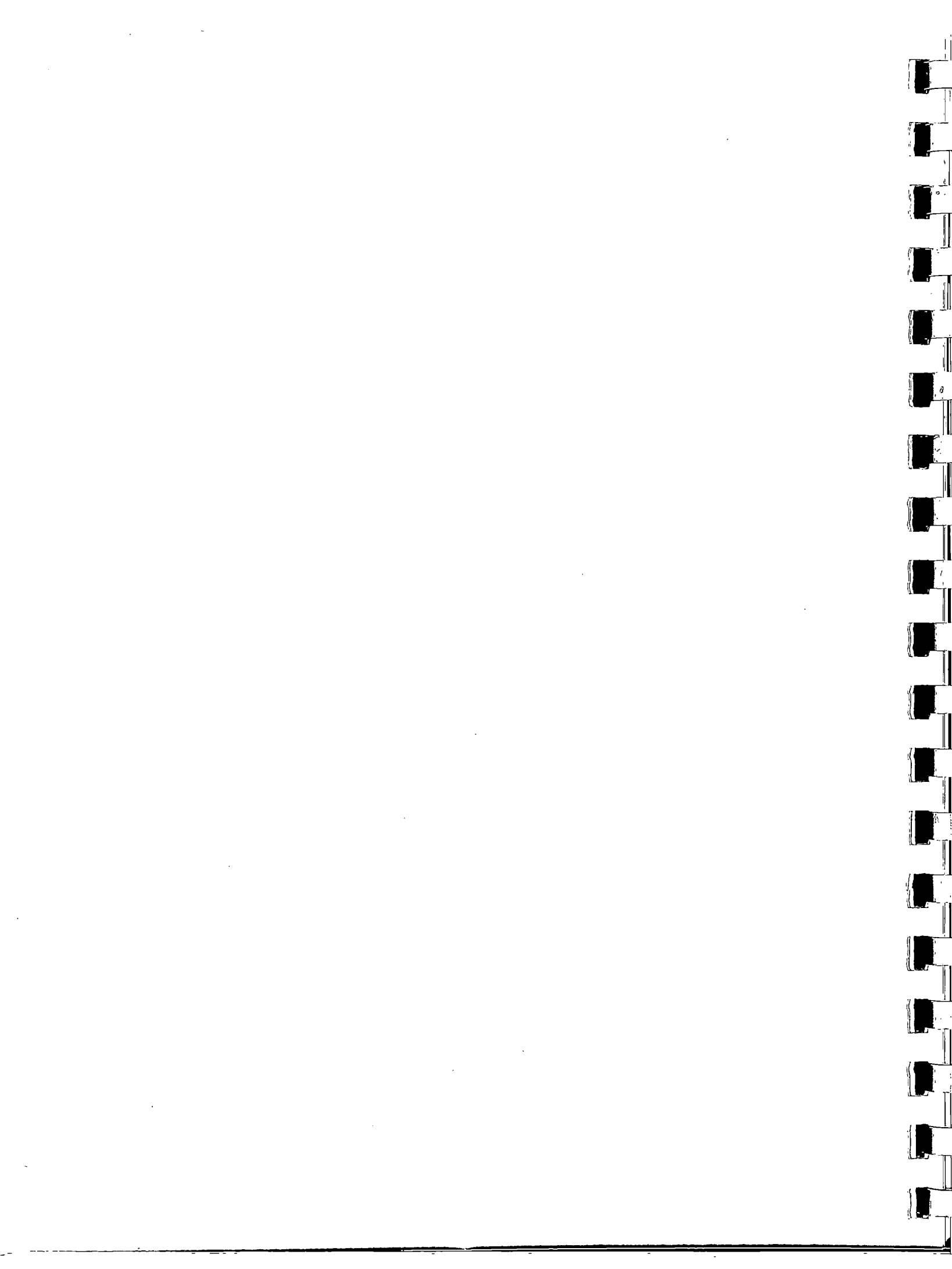
10. Discuss the physical and psychological benefits derived from health-related fitness activities.
11. Describe how sports injuries can be prevented.
12. Design and evaluate a personal fitness plan, taking into consideration fitness, health and nutritional status, age, interests, and abilities, and discuss how the plan may be adapted to injury, illness, or aging.





LANGUAGE ARTS LITERACY





New Jersey Core Curriculum Standards for Language Arts Literacy

Introduction

Language Arts are the abilities that enable one to think logically and creatively; express ideas; understand and participate meaningfully in spoken, written, and nonverbal communications; formulate and answer questions; and search for, organize, evaluate, and apply information. The language arts are integrative, interactive ways of thinking that develop through reading, writing, speaking, listening, and viewing. Literacy is the ability to think, as well as know how to acquire knowledge for thinking and communicating. Literacy is more than the acquisition of a specific, predetermined set of skills in reading, writing, speaking, listening, and viewing. It is also recognizing one's own purposes for thinking and communicating (through print or nonprint, verbal or nonverbal means) and being able to use one's own resources to achieve those purposes.

Voices in the classroom resound when children use language to represent experience. For children, as for everyone, language is the primary instrument for making sense of the world and a primary way to connect with others. While language is a powerful means of communicating, it goes beyond the mere sharing of ideas and information. Language evokes histories, emotions, values, issues, knowledge, and inventions. It is what we share and what sets us apart, one from another.

The New Jersey core curriculum standards for Language Arts Literacy capture language experiences all children need in order to grow intellectually, socially, and emotionally in classrooms across the curriculum. The standards are intended to promote students' capacities to construct meaning in any arena, with others as well as on their own. If students learn to read, write, speak, listen, and view critically, strategically, and creatively, and if they learn to use these arts individually and in groups, they will have the literacy skills they need to discover personal and shared meaning throughout their lives.

Concerns about how these standards represent language arts reveal two views about why language arts are essential learning. On the one hand, we want students to develop the skills they will need to bring to society as adults: critical thinking, problem-solving, and creativity. On the other hand, we want students to discover the inner joy and self-illumination that come with reading great literature and communicating well in speech and writing, and to take these into their adult lives as well. The two views are complementary: As we strive for the goals of one, we can foster the goals of the other.

Underlying the Standards for Language Arts Literacy are four assumptions about language learning. First, language use is an active process of constructing meaning. Even the most quiet listener is actively working to link prior knowledge and understanding to what other people say. Second, language develops in a social context. While we use language in private activities, our use of language almost always relates to others. We are the active audience for those who create spoken, written, or visual texts; others listen to our thoughts and read our writing. Third, language ability increases in complexity if language is used in increasingly complex ways. Language learners must engage in texts and conversations that are rich in ideas and increasingly complex in the patterns of language they display. Finally, learners achieve language arts literacy not by adding skills one-by-one to their repertoire, but rather by using and exploring language in its many dimensions.

Although the standards define five language arts, these arts are not discrete skills or content. The language arts are interdependent processes that inform and enrich each other, more often than not merging in an integrated act of learning and knowing. The division of language arts into separate standards is merely a method that allows us to highlight the special features of each and to identify developmentally appropriate behaviors among language arts learners. The separation is not meant to suggest hierarchical order, or any linear or sequential approach to literacy instruction. The standards should be construed and applied as integrated aspects of teaching and learning. They are intended not as a curriculum guide, but as a catalyst for curriculum development and revision.

**LANGUAGE ARTS LITERACY
LIST OF STANDARDS**

- 3.1 All students will speak for a variety of real purposes and audiences.
- 3.2 All students will listen actively in a variety of situations to information from a variety of sources.
- 3.3 All students will write in clear, concise, organized language that varies in content and form for different audiences and purposes.
- 3.4 All students will read various materials and texts with comprehension and critical analysis.
- 3.5 All students will view, understand, and use nontextual visual information.

**LANGUAGE ARTS AND LITERACY
STANDARDS AND PROGRESS INDICATORS**

**STANDARD 3.1 ALL STUDENTS WILL SPEAK FOR A VARIETY OF REAL
PURPOSES AND AUDIENCES.**

Descriptive Statement: Speaking, both formally and informally, is critical to the learning process. Language arts literacy develops when students in large and small groups engage in discourse and dialogue about literature, nonfiction, and topics of current concern and interest. Students should have opportunities to prepare and participate in more formal presentations, such as speeches, panel discussions, and debates. They should have opportunities to use language for a variety of other purposes, including questioning, sharing information, telling a humorous story, and helping others to achieve goals. Students should recognize that what they hear, write, read, and view contributes to the content and quality of their oral language.

Cumulative Progress Indicators

By the end of **Grade 4**, students:

1. Use listening, writing, reading, and viewing to assist with speaking.
2. Adjust oral communications for different purposes and audiences.
3. Use oral communication to influence the behavior of others.
4. Modify oral communication in response to the reactions of others.
5. Participate in collaborative speaking activities, such as choral reading, plays, and reciting of poems.
6. Participate in discussion by alternating the roles of speaker and listener.
7. Talk with others to identify, explore, and solve problems.
8. Speak before a group to express thoughts and ideas, convey an opinion, present information, and tell a story.
9. Use the conventions of spoken English, such as grammar and appropriate forms of address.
10. Read aloud with meaning.
11. Give directions and/or instructions.
12. Tell, retell, summarize, and paraphrase ideas.
13. Use visual aids and nonverbal behaviors to support spoken messages.

Building upon knowledge and skills gained in the preceding grades, by the end of **Grade 8**, students:

14. Use clear, concise, organized language in speaking situations.
15. Speak before a group to defend an opinion and present an oral interpretation.
16. Recognize when audiences do not understand the message, and make appropriate adjustments.
17. Conduct an informational interview.
18. Receive and use constructive feedback to improve speaking ability.

Building upon knowledge and skills gained in the preceding grades, by the end of **Grade 12**, students:

19. Identify the elements of debate.
20. Prepare for and participate in structured debates and panel discussions.
21. Present an extemporaneous speech.
22. Demonstrate interview skills in real-life situations, such as college admissions or employment.

STANDARD 3.2 ALL STUDENTS WILL LISTEN ACTIVELY IN A VARIETY OF SITUATIONS TO INFORMATION FROM A VARIETY OF SOURCES.
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Descriptive Statement: Through active listening, students gain understanding and appreciation of language and communication. They develop an awareness of the role of sound, including intonation, rhythm, pace, enunciation, volume, and quality, in combination with words and/or visual presentations to convey meaning. Effective listeners are able to restate, interpret, respond to, and evaluate increasingly complex messages conveyed through sound. Students should have opportunities to listen to language used for a variety of purposes including telling a story, sharing information, questioning, persuading, and helping others to achieve goals. Students should recognize that what they say, write, read, and view contributes to the content and quality of their listening experiences.

Cumulative Progress Indicators

By the end of Grade 4, students:

1. Use speaking, writing, reading, and viewing to assist with listening.
2. Demonstrate comprehension of a story, interview, and oral report of an event or incident.
3. Listen for a variety of purposes, such as enjoyment and obtaining information.
4. Interpret meaning through sounds, such as how speaking style reveals character in an oral interpretation.
5. Listen attentively and critically to a variety of speakers.
6. Develop listening strategies, such as asking relevant questions, taking notes, and making predictions, to understand what is heard.
7. Follow oral directions.

Building upon knowledge and skills gained in the preceding grades, by the end of Grade 8, students:

8. Demonstrate comprehension of, and appropriate listener response (e.g., listening attentively) to, an oral report, discussion, and interview.
9. Give appropriate feedback to a variety of speakers.
10. Recognize persuasive techniques and credibility in oral communication.

Building upon knowledge and skills gained in the preceding grades, by the end of **Grade 12**, students:

11. Demonstrate comprehension of, and appropriate listener response to, ideas in a persuasive speech, an oral interpretation of a literary selection, interviews in a variety of real-life situations, and educational and scientific presentations.
12. Evaluate the credibility of the speaker.
13. Evaluate media techniques and messages.

STANDARD 3.3 ALL STUDENTS WILL WRITE IN CLEAR, CONCISE, ORGANIZED LANGUAGE THAT VARIES IN CONTENT AND FORM FOR DIFFERENT AUDIENCES AND PURPOSES.
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Descriptive Statement: Writing is a complex process that may be used for self or others in communication, expression, and learning. Proficient writers have a repertoire of strategies that enables them to vary forms, style, and conventions in order to write for different audiences, contexts, and purposes.

Writing activities should include opportunities for students to think about their ideas and feelings and the events and people in their lives. Through writing, students are able to describe experiences, examine and organize their perceptions of them, and link them to events and experiences in the lives of others. Students should be helped to understand the recursive nature and shifting perspectives of the writing process, and should be encouraged to take risks, collaborate, and reflect as they compose increasingly complex texts. Students should be taught strategies that will assist them in writing clearly and in crafting their texts with appropriate conventions of spelling, grammar, and punctuation as they revise, edit, and publish. They should learn to examine their writing not only as a product but also as a mode of thinking. They should recognize that what they hear, speak, read, and view contributes to the content and quality of their writing. Writers need to be able to complete projects for a variety of purposes.

Cumulative Progress Indicators

By the end of Grade 4, students:

1. Use speaking, listening, reading, and viewing to assist with writing.
2. Write from experiences, thoughts, and feelings.
3. Use writing to extend experience.
4. Write for a variety of purposes, such as to persuade, enjoy, entertain, learn, inform, record, respond to reading, and solve problems.
5. Write on self-selected topics in a variety of literary forms.
6. Write collaboratively and independently.
7. Use a variety of strategies and activities, such as brainstorming, listing, discussion, drawing, role playing, note-taking, and journal writing, for finding and developing ideas about which to write.
8. Write to synthesize information from multiple sources.
9. Use figurative language, such as simile, metaphor, and analogies to expand meaning.
10. Revise content, organization and other aspects of writing, using self, peer, and teacher collaborative feedback (the shared responses of others).

11. Edit writing for developmentally appropriate syntax, spelling, grammar, usage, and punctuation.
12. Publish writing in a variety of formats.
13. Establish and use criteria for self and group evaluation of written products.
14. Develop a portfolio or collection of writings.

Building upon knowledge and skills gained in the preceding grades, by the end of **Grade 8**, students:

15. Understand that written communication can affect the behavior of others.
16. Write technical materials, such as instructions for playing a game, that include specific details.
17. Cite sources of information.

Building upon knowledge and skills gained in the preceding grades, by the end of **Grade 12**, students:

18. Write for real audiences and purposes, such as job applications, business letters, college applications, and memoranda.
19. Write a research paper that synthesizes and cites data.

STANDARD 3.4 ALL STUDENTS WILL READ A VARIETY OF MATERIALS AND TEXTS WITH COMPREHENSION AND CRITICAL ANALYSIS.

Descriptive Statement: Reading is a complex process through which readers actively construct meaning and connect with others' ideas. The reading process requires readers to relate prior knowledge and personal experiences to written texts; respond to texts in aesthetic and critical ways; recognize and appreciate print as a cuing system for meaning; and understand words, their variations, and their contexts. Students should recognize that what they hear, speak, write, and view contributes to the content and quality of their reading experiences.

Proficient readers use a repertoire of strategies (including phonics, context clues, and foreshadowing) that enables them to adapt to increasing levels of complexity, and they develop lifelong habits of reading and thinking. A diversity of materials provides students with opportunities to grow intellectually, socially, and emotionally as they consider universal themes, diverse cultures and perspectives, and the common aspects of human existence. The study of literature allows students to return to the materials and reconstruct meaning as they examine their own reading along with the writer's shaping of text and the cultural, historical, and psychological contexts for composing.

Cumulative Progress Indicators

By the end of **Grade 4**, students:

1. Use listening, speaking, writing, and viewing to assist with reading.
2. Listen and respond to whole texts.
3. Understand that authors write for different purposes, such as persuading, informing, entertaining, and instructing.
4. Use reading for different purposes, such as enjoyment, learning, and problem-solving.
5. Read independently a variety of literature written by authors of different cultures, ethnicities, genders, and ages.
6. Read literally, inferentially, and critically.
7. Use print concepts in developmentally appropriate ways.
8. Read with comprehension.
9. Use prior knowledge to extend reading ability and comprehension and to link aspects of the text with experiences and people in their own lives.
10. Identify passages in the text that support their point of view.
11. Distinguish personal opinions and points of view from those of the author, and distinguish fact from opinion.

12. Demonstrate comprehension through retelling or summarizing ideas and following written directions.
13. Identify elements of a story, such as characters, setting, and sequence of events.
14. Identify literary forms, such as fiction, poetry, drama, and nonfiction.
15. Expand vocabulary using appropriate strategies and techniques, such as word analysis and context clues.
16. Read and use printed materials and technical manuals from other disciplines, such as science, social studies, mathematics, and applied technology.

Building upon knowledge and skills gained in the preceding grades, by the end of **Grade 8**, students:

17. Read more than one work by a single author.
18. Begin to identify common aspects of human existence.
19. Recognize propaganda and bias in written texts.
20. Analyze main ideas and supportive details.
21. Analyze text using patterns of organization, such as cause and effect, comparison and contrast.
22. Analyze text for the purpose, ideas, and style of the author.
23. Understand the role of characters, setting, and events in a given literary work.
24. Understand the concepts of figurative language, symbolism, allusion, connotation, and denotation.
25. Gather and synthesize data for research from a variety of sources, including print materials, technological resources, observation, interviews, and audiovisual media.

Building upon knowledge and skills gained in the preceding grades, by the end of **Grade 12**, students:

26. Understand the relationship between contemporary writing and past literary traditions.
27. Understand that our literary heritage is marked by distinct literary movements and is part of a global literary tradition.
28. Analyze how the works of a given period reflect historical events and social conditions.
29. Understand the study of literature and theories of literary criticism.
30. Understand appropriate literary concepts, such as rhetorical device, logical fallacy, and jargon.
31. Understand the effect of literary devices, such as alliteration and figurative language, on the reader's emotions and interpretation.
32. Understand the range of literary forms and content that elicit aesthetic response.

STANDARD 3.5 ALL STUDENTS WILL VIEW, UNDERSTAND, AND USE NONTEXTUAL VISUAL INFORMATION.

Descriptive Statement: In the language arts literacy classroom, students learn how to view in order to be able to respond thoughtfully and critically to the visual messages of both print and nonprint. Effective viewing is essential to comprehend and respond to personal interactions, live performances, visual arts that involve oral and/or written language, and both print media (graphs, charts, diagrams, illustrations, photographs, and graphic design in books, magazines, and newspapers) and electronic media (television, computers, film). Students should recognize that what they speak, hear, write, and read contributes to the content and quality of their viewing.

Cumulative Progress Indicators

By the end of **Grade 4**, students:

1. Use speaking, listening, writing, and reading to assist with viewing.
2. Demonstrate the ability to gain information from a variety of media.
3. Articulate awareness of different media forms and how these contribute to communication.
4. Articulate information conveyed by symbols such as those found in pictorial graphs, map keys, and icons on a computer screen.
5. Respond to and evaluate the use of illustrations to support text.
6. Recognize and use pictorial information that supplements text.
7. Use symbols, drawings, and illustrations to represent information that supports and/or enhances their writing.
8. Use simple charts, graphs, and diagrams to report data.
9. Distinguish between factual and fictional visual representations.
10. Take notes on visual information from films, presentations, observations, and other visual media, and report that information through speaking, writing, or their own visual representations.

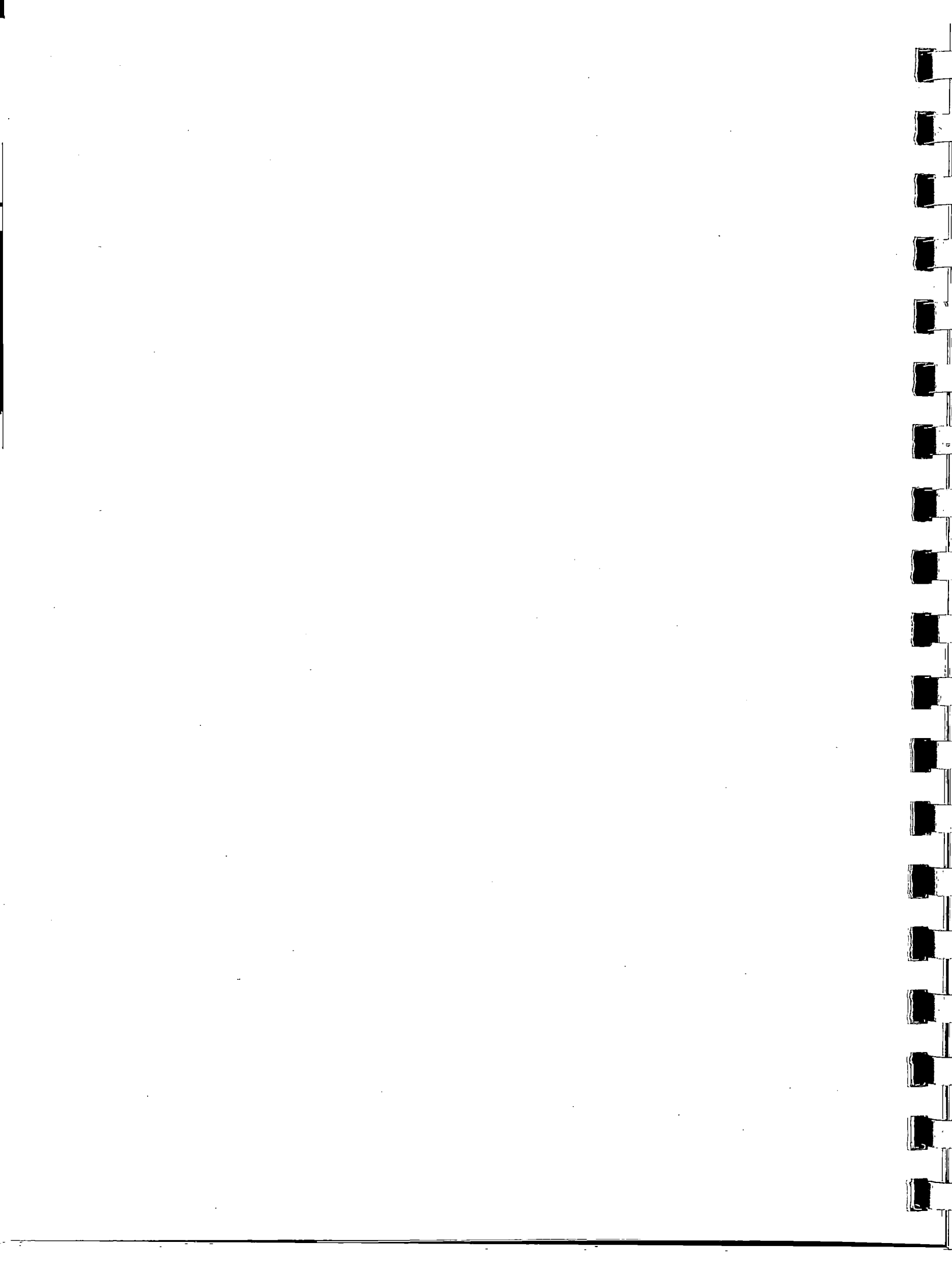
Building upon knowledge and skills gained in the preceding grades, by the end of **Grade 8**, students:

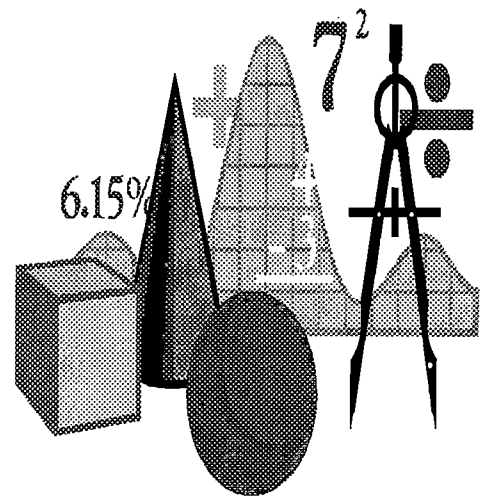
11. Recognize and respond to visual messages of humor, irony, metaphor.
12. Articulate the connection between visual and verbal message.
13. Choose and use multiple forms of media to convey what has been learned.
14. Integrate multiple forms of media into a finished product.

15. Evaluate media for credibility.
16. Compare and contrast media sources, such as book and film versions of a story.

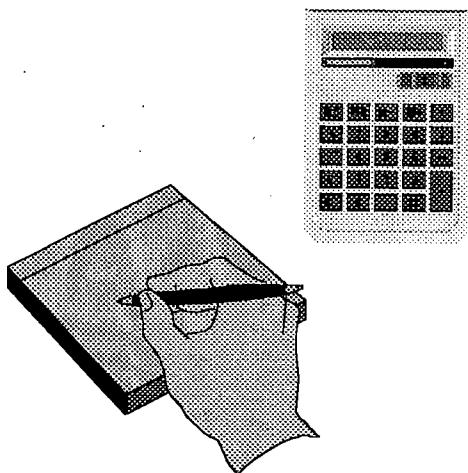
Building upon knowledge and skills gained in the preceding grades, by the end of **Grade 12**, students:

17. Solve problems using multimedia technology and be able to browse, annotate, link, and elaborate on information in a multimedia data base.





MATHEMATICS



New Jersey Core Curriculum Content Standards for Mathematics

Introduction

Somewhere in a New Jersey elementary school:

The students in Mrs. Chaplain's fifth grade class eagerly return from recess, excited by the prospect of working on another of her famous Chaplain's Challenges. Mrs. Chaplain regularly uses a Challenge with her math class, and today she has promised the children that the problem would be a great one. She believes that all of her students will be up to the Challenge and expects that it will engage them in an exploration and discussion of the relationship between area and perimeter.

*Suppose you had 64 meters of fencing to build a pen for your large pet dog. What are some of the different pens you could build if you used all of the fencing? Which pen would have the most play space? Which would give the most running space? What would be the best pen? **

As the students file into the classroom, they stand, scattered around the room, reading the Challenge from the board even before finding their seats. Then they begin to ask questions about it. *What is fencing? Wouldn't the pen with the most play space*

Continued in the left column on the following pages

Somewhere in a New Jersey high school:

Ms. Diego's algebra class and Mr. Browning's physical science class are jointly investigating radioactive decay. The two teachers, with the support of the school administrators, have worked out a schedule that enables their classes to meet together this month to explore some of the mathematical aspects of the physical sciences. Both teachers regularly incorporate some content from the other's discipline in class activities, but this month was specially planned to be a kind of celebration of the relationship between the two areas. By the end of the month, they expect that the students will really appreciate the role that mathematics plays in the sciences, and the problems presented by the sciences that call for innovative mathematical solutions.

The classes are average. Nearly every student in the high school takes these two classes at some point during their stay and, over the past few years, because of exciting real-world problems like the one on which they are working this week, the classes have become two of the most popular in the school.

Continued in the right column on the following pages

**This problem was adapted from one that appears in the Professional Standards for Teaching Mathematics, National Council of Teachers of Mathematics, 1991.*

In the elementary school ...

be the same as the one with the most running space? What shapes are allowed? Mrs. Chaplain answers some of these questions directly (she has brought a sample of fencing to class so she could show the students what it looks like), but, for the most part, she tells the students that they can discuss their questions in their regular working groups.

The groups begin their exploration by discussing how to organize their efforts. One of the first questions to arise is what kinds of tools would help solve the problem. The students have used a variety of materials to deal with Chaplain's Challenges, and they have often found that the groups that fashioned the best models of the problem situations were the ones who found it easiest to find solutions. Today, one group decides to use the 10-by-10 geoboards, figuring that they can quickly make a lot of different "pens" out of rubber bands if they let the space between nails equal four meters. Another group decides to get some graph paper on which to draw their pens, because that gives them a lot of flexibility. Still another group, reluctant to be limited to rectangular shapes and work spaces, thinks that the geometry construction software loaded on the computers in the back of the room would let them draw a variety of shapes and even help them measure various characteristics of the shapes. One last group, striving for realism, decides to use a loop of string sixty-four inches long. As the session progresses, the groups of students make many sample pens with whatever materials they have chosen to use. Some groups switch materials as they perceive other materials to be less restrictive than the ones they are using. Keeping the perimeter a constant 64 meters, they measure the areas of the pens using some of the strategies they developed the week before. Mrs. Chaplain circulates around the room, paying careful attention to the contributions of individual students, making notes to herself about two particular children, one who seems to be having difficulty with the concept of area, and another who is doing a nice job of leading her group to a solution.

Gradually, the work becomes more symbolic and verbal and less concrete. The students begin to

In the high school...

Monday's class begins with a presentation by Mr. Browning about the process of carbon dating. He describes the problem that archaeologists faced in the 1940s with respect to determining the age of a fossil. They knew that all living things contained a predictable amount of radioactive carbon that began to diminish as soon as the organism died. If they could measure the amount that remained in some discovered fossil and if they knew the rate at which the carbon "decayed," they could figure out the age of the object. An American chemist named Willard Libby developed a technique that allowed them to do so. Ms. Diego explains that the classes will spend the next few days exploring the concept of radioactive decay and, toward the end of the week, they will be able to solve some of the same kinds of problems solved by those archaeologists.

On Tuesday, working at stations created by the teachers, the students begin to explore both the mathematical and scientific aspects of radioactive decay. Working in groups, the students use sets of 50 dice to simulate collections of radioactive nuclei. Each roll of the collection of dice represents the passage of one day. Any time a die lands with a "1" showing, it "spontaneously decays" and is taken out of the collection. The students plot the number of radioactive nuclei left versus the number of days passed in an effort to determine the half-life of the element - the amount of time it takes for half of the element to decay. Because the experiment is relatively well controlled, each group working on the task produces a graph that effectively illustrates the decay, but because the process is also a truly random process, each group's results are slightly different from those of other groups.

On Wednesday, in a very different kind of activity, students use graphing calculators in a guided activity to discover properties of exponential functions, and the effects on the graphs of various changes to the parameters in the functions. Working from a worksheet prepared by the teachers they start with the general form of an exponential function, $y = ab^x$. Using the values $a = 1$ and $b = 2$, they input the equation into the calculators and study the

In the elementary school...

make tables to record the dimensions and descriptions of their pens and to look for some kind of pattern, because they have learned from experience that this frequently leads to insights. One group follows the teacher's suggestion and enters their table of values for rectangular pens into a computer, generating a broken-line graph of the length of the pen versus its area.

Toward the end of the class, the students become comfortable with their discoveries. Mrs. Chaplain reflects again on how glad she is that the faculty decided to organize the school schedule to allow for these extended class sessions. When she sees how involved and active the students are, how they try to persuade each other to follow one path or another, how their verbalizations either cement their own understandings or provide opportunities for others to point out flaws in their thinking, she realizes that only with this kind of time and this kind of effort can she do an adequate job of teaching mathematics.

The summary discussion at the end of the session allows the students an opportunity to see what their classmates have done and to evaluate their own group's results. Mrs. Chaplain learns that everyone in the class understands that if you hold the perimeter constant, you can create figures with a whole range of areas. Moreover, she feels that a majority of the class also has come to the generalization that the more compact a figure is, the greater its area, and the more stretched out it is, the smaller its area.

But the students still have very different answers to the question, *What would be the best pen?* That fits her plans perfectly. For homework, Mrs. Chaplain asks each student to design the pen that he or she thinks is best, draw a diagram of it, label its dimensions and its area, and write a paragraph about why that particular pen would be best for the dog. Mrs. Chaplain plans to move on from this activity to others where the students concentrate on more efficient strategies for finding the areas of some of the non-rectangular shapes they explored in the Challenge.

In the high school...

resulting graph. Then, they systematically change the values of a and b to discover what each change does to the graph. They are directed by the worksheet to pay particular attention to the effect of changing b to a value between zero and one, because graphs of that type will be especially important for their work with radioactive decay. The culminating problem on the worksheet is a challenge to try to find the values of a and b that produce a graph that looks like the ones that resulted from the experiment with the dice. The students enjoy the problem and use their calculators to quickly check and refine their solutions, zeroing in on the critical numbers. There is a lot of discussion about why those numbers might be the correct ones.

On Thursday, the students discuss a reading that was assigned for homework the night before, focusing on carbon dating and addressing some of the mathematical processes used to determine the age of fossils. This discussion is led by the two teachers, who have brought in some fossilized samples to better acquaint the students with the kind of materials they read about. Ms. Diego then leads a session to develop the computational procedures for solving the carbon dating problems using exponential functions. The students will be given some homework problems of this type and will spend tomorrow's class discussing those problems and wrapping up the unit. The teachers are very pleased with what the classes have accomplished. The active involvement with a hands-on experiment simulating decay, the symbolic manipulations and graph explorations made possible by the graphing calculator, and the study of a particular scientific application of the mathematics have been quite productive. By working together as a team, the teachers have been able to relate the different aspects of the phenomenon to each other. The students have learned a great deal of both mathematics and science and have seen how strongly they are linked.

The vision of the New Jersey core curriculum content standards for Mathematics revolves around what takes place in classrooms like those described in the previous pages. It is focused on achieving one crucial goal:

To enable ALL of New Jersey's children to move into the twenty-first century with the mathematical skills, understandings, and attitudes that they will need to be successful in their careers and daily lives.

With this goal in mind, the following two standards explicitly address the learning environment in mathematics classrooms. They deal with concerns for fostering success in mathematics for all students, and for the linking of assessment to learning and instruction.

1. All students' mathematical learning will embody the concepts that engagement in mathematics is essential, and that decision-making, risk-taking, cooperative work, perseverance, self-assessment, and self-confidence are frequently keys to success.
2. All students will be evaluated using a diversity of assessment tools and strategies, to provide multiple indicators of the quality of every student's mathematical learning and of overall program effectiveness.

As more and more New Jersey teachers incorporate the recommendations of the New Jersey Mathematics Standards into their teaching, we should see the following results (as described in Mathematics to Prepare Our Children for the 21st Century: A Guide for New Jersey Parents, N.J. Mathematics Coalition, 1994):

Students who are excited by and interested in their activities. A principal goal is for children to learn to enjoy mathematics. Students who are excited by what they are doing are more likely to truly understand the material, to stay involved over a longer period of time, and to take more advanced courses voluntarily. When math is taught with a problem-solving spirit, and when children are allowed to make their own hands-on mathematical discoveries, math can be engaging for all students.

Students who are learning important mathematical concepts rather than simply memorizing and practicing procedures. Student learning should be focused on understanding when and how mathematics is used and how to apply mathematical concepts. With the availability of technology, students need no longer spend the same amount of study time practicing lengthy computational processes. More effort should be devoted to the development of number sense, spatial sense, and estimation skills.

Students who are posing and solving meaningful problems. When students are challenged to use mathematics in meaningful ways, they develop their reasoning and problem-solving skills and come to realize the potential usefulness of mathematics in their lives.

Students who are working together to learn mathematics. Children learn mathematics well in cooperative settings, where they can share ideas and approaches with their classmates.

Students who write and talk about math topics every day. Putting thoughts into words helps to clarify and solidify thinking. By sharing their mathematical understandings in written and oral form with their classmates, teachers, and parents, students develop confidence in themselves as mathematical learners; this practice also enables teachers to better monitor student progress.

Calculators and computers being used as important tools of learning. Technology can be used to aid teaching and learning, as new concepts are presented through explorations with calculators or computers. But technology can also be used to assist students in solving problems, as it is used by adults in our society. Students should have access to these tools, both in school and after school, whenever they can use technology to do more powerful mathematics than they would otherwise be able to do.

Teachers who have high expectations for ALL of their students. This vision includes a set of achievable, high-level expectations for the mathematical understanding and performance of all students. Although more ambitious than current expectations for most students, these standards are absolutely essential if we are to reach our goal. Those students who can achieve more than this set of expectations must be afforded the opportunity and encouraged to do so.

A variety of assessment strategies rather than sole reliance on traditional short-answer tests. Strategies including open-ended problems, teacher interviews, portfolios of best work, and projects, in combination with traditional methods, will provide a more complete picture of students' performance and progress.

Learning environments like this should and can become the reality in virtually all New Jersey classrooms before the turn of the century. Making this vision a reality is both necessary and achievable.

Perhaps the most compelling reason for this vision of mathematics education is that our children will be better served by higher expectations, by curricula which go far beyond basic skills and include a variety of mathematical models, and by programs which devote a greater percentage of instructional time to problem-solving and active learning. Many students respond to the current curriculum with boredom and discouragement, develop the perception that success in mathematics depends on some innate ability which they simply do not have, and feel that, in any case, mathematics will never be useful in their lives. Learning environments like the one conceived in these standards will help students to enjoy and appreciate the value of mathematics, to continue

to develop the tools they need for varied educational and career options, and to function effectively as citizens and consumers.

Preparing our students for careers in the twenty-first century requires that we make this vision a reality. Our curricula are often preoccupied with what national reports call "shopkeeper mathematics," competency in the basic operations that were needed to run a small store several generations ago; yet very few of our students will have careers as shopkeepers. To compete in today's global, information-based economy, students must also be able to solve real problems, reason effectively, and make logical connections. Jobs requiring mathematical knowledge and skills in areas such as data analysis, problem-solving, pattern recognition, statistics, and probability are growing at nearly twice the rate of growth of overall employment. To prepare students for such careers, the mathematics curriculum must change.

This vision of excellent mathematical education is based on the twin premises that all students can learn mathematics and that all students need to learn mathematics. In order to take seriously the goal of preparing all students for twenty-first century careers, we must overcome the all too common perception among students that they simply lack mathematical ability:

Only in the United States do people believe that learning mathematics depends on special ability. In other countries, students, parents, and teachers all expect that most students can master mathematics if only they work hard enough. The record of accomplishment in these countries - and in some intervention programs in the United States - shows that most students can learn much more mathematics than is commonly assumed in this country.

Mathematical Sciences Education Board, 1989

Curricula that assume student failure are bound to fail; we need to develop curricula that assume student success.

A first step in curriculum development is the formulation of goals. For that purpose, sixteen mathematics content standards have been delineated to translate the vision into specific goals. The term standard here encompasses both goals and expectations, but is also meant to convey the older meaning of banner or rallying point. These mathematics standards are intended as a definition of excellent practice, of what can be achieved if all New Jersey communities rally behind the standards so that this excellent practice will become common practice. The sixteen standards in this section were not designed as minimum standards, but rather as world-class standards which will enable all of our students to compete in the global marketplace of the twenty-first century.

These sixteen standards, along with the two additional learning environment standards listed above, define the critical goals of mathematics education today. In addition to more familiar content are many topics which have not been part of the traditional curriculum. Included are new

emphases on the whys and hows of mathematics learning: posing and solving real world problems, effectively communicating mathematical ideas, making connections within mathematics and between mathematics and other areas, active student involvement, the uses of technology, and the relationship between assessment and instruction.

Although philosophically aligned with the Curriculum and Evaluation Standards for School Mathematics of the National Council of Teachers of Mathematics (1989), the New Jersey Mathematics Standards are designed to reflect conditions specific to New Jersey, as well as national changes in mathematics education since the NCTM document was written.

The standards rest on the notion that an appropriate mathematics curriculum results from a series of critical decisions about three inseparably linked components: content, instruction, and assessment. All students must have the opportunity to develop an understanding and a command of mathematics in an environment that provides for both affective and intellectual growth. The New Jersey Mathematics Standards place high value on both process and product, describe appropriate learning environments, and challenge us to formulate effective assessment strategies which both inform instruction and improve learning. But these standards will only promote substantial and systemic improvement in mathematics education if the what of the content being learned, the how of the problem-solving orientation, and the where of the active, equitable, involving learning environment are synergistically woven together in every classroom.

These standards also contain a strong focus on the use of technology as a regular, integral part of school mathematics curricula at every grade level. The state mandate for the use of calculators in statewide assessment is but one indication of the strong movement that has already begun in this direction. Teachers and students who adopt these standards will understand, and develop the abilities to use, powerful, up-to-date mathematics and technology.

Implicit in the vision and these standards is the notion that there should be a core curriculum for grades K-12. What does a "core curriculum" mean? It means that every student will be involved in experiences addressing all of the expectations of each of the sixteen content standards. It also means that all courses of study should have a common goal of completing this core curriculum, no matter how students are grouped or separated by needs and/or interests.

A core curriculum does not mean that all students will be enrolled in the same courses. Students have different aptitudes, interests, educational and professional plans, learning habits, and learning styles. Different groups of students should address the core curriculum at different levels of depth, and should complete the core curriculum according to different timetables. Nevertheless, all students should complete all elements of the core curriculum recommended in the New Jersey Mathematics Standards.

A curriculum framework has been developed to assist teachers and districts in implementing these mathematics standards. The document includes not only an elaboration and clarification of the

content standards, but also an expanded discussion of the two additional learning environment standards listed earlier in this introduction. The result of a collaborative effort of the New Jersey Mathematics Coalition and the New Jersey Department of Education, with Eisenhower funding from the United States Department of Education, a preliminary version was published early in 1995 and a revised version will be available in spring 1996.

The New Jersey core curriculum content standards for Mathematics presented in this chapter offer a powerful challenge to all teachers, schools, and districts: to enable all of our students to step forward into the twenty-first century with the mathematical skills, understandings, and attitudes that they will need to be successful in their careers and daily lives. The standards are also a powerful tool to help us meet that challenge, providing a vision and standards which both inform us and rally us in our efforts. It will not be easy to meet this challenge, nor can it happen overnight. But it can happen if all of us together decide to make it happen.

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MATHEMATICS LIST OF STANDARDS

- 4.1 All students will develop the ability to pose and solve mathematical problems in mathematics, other disciplines, and everyday experiences.
- 4.2 All students will communicate mathematically through written, oral, symbolic, and visual forms of expression.
- 4.3 All students will connect mathematics to other learning by understanding the interrelationships of mathematical ideas and the roles that mathematics and mathematical modeling play in other disciplines and in life.
- 4.4 All students will develop reasoning ability and will become self-reliant, independent mathematical thinkers.
- 4.5 All students will regularly and routinely use calculators, computers, manipulatives, and other mathematical tools to enhance mathematical thinking, understanding, and power.
- 4.6 All students will develop number sense and an ability to represent numbers in a variety of forms and use numbers in diverse situations.
- 4.7 All students will develop spatial sense and an ability to use geometric properties and relationships to solve problems in mathematics and in everyday life.
- 4.8 All students will understand, select, and apply various methods of performing numerical operations.
- 4.9 All students will develop an understanding of and will use measurement to describe and analyze phenomena.
- 4.10 All students will use a variety of estimation strategies and recognize situations in which estimation is appropriate.
- 4.11 All students will develop an understanding of patterns, relationships, and functions and will use them to represent and explain real-world phenomena.
- 4.12 All students will develop an understanding of statistics and probability and will use them to describe sets of data, model situations, and support appropriate inferences and arguments.

- 4.13 All students will develop an understanding of algebraic concepts and processes and will use them to represent and analyze relationships among variable quantities and to solve problems.
- 4.14 All students will apply the concepts and methods of discrete mathematics to model and explore a variety of practical situations.
- 4.15 All students will develop an understanding of the conceptual building blocks of calculus and will use them to model and analyze natural phenomena.
- 4.16 All students will demonstrate high levels of mathematical thought through experiences which extend beyond traditional computation, algebra, and geometry.

MATHEMATICS STANDARDS AND PROGRESS INDICATORS

STANDARD 4.1 ALL STUDENTS WILL DEVELOP THE ABILITY TO POSE AND SOLVE MATHEMATICAL PROBLEMS IN MATHEMATICS, OTHER DISCIPLINES, AND EVERYDAY EXPERIENCES.

Descriptive Statement: Problem posing and problem solving involve examining situations that arise in mathematics and other disciplines and in common experiences, describing these situations mathematically, formulating appropriate mathematical questions, and using a variety of strategies to find solutions. By developing their problem-solving skills, students will come to realize the potential usefulness of mathematics in their lives.

Cumulative Progress Indicators

By the end of **Grade 4**, students:

1. Use discovery-oriented, inquiry-based, and problem-centered approaches to investigate and understand mathematical content appropriate to early elementary grades.
2. Recognize, formulate, and solve problems arising from mathematical situations and everyday experiences.
3. Construct and use concrete, pictorial, symbolic, and graphical models to represent problem situations.
4. Pose, explore, and solve a variety of problems, including non-routine problems and open-ended problems with several solutions and/or solution strategies.
5. Construct, explain, justify, and apply a variety of problem-solving strategies in both cooperative and independent learning environments.
6. Verify the correctness and reasonableness of results and interpret them in the context of the problems being solved.
7. Know when to select and how to use grade-appropriate mathematical tools and methods (including manipulatives, calculators and computers, as well as mental math and paper-and-pencil techniques) as a natural and routine part of the problem-solving process.
8. Determine, collect, organize, and analyze data needed to solve problems.
9. Recognize that there may be multiple ways to solve a problem.

Building upon knowledge and skills gained in the preceding grades, and demonstrating continued progress in Indicators 4, 5, 6, 7, and 8 above, by the end of **Grade 8**, students:

10. Use discovery-oriented, inquiry-based, and problem-centered approaches to investigate and understand mathematical content appropriate to the middle grades.
11. Recognize, formulate, and solve problems arising from mathematical situations, everyday experiences, and applications to other disciplines.
12. Construct and use concrete, pictorial, symbolic, and graphical models to represent problem situations and effectively apply processes of mathematical modeling in mathematics and other areas.
13. Recognize that there may be multiple ways to solve a problem, weigh their relative merits, and select and use appropriate problem-solving strategies.
14. Persevere in developing alternative problem-solving strategies if initially selected approaches do not work.

Building upon knowledge and skills gained in the preceding grades, and demonstrating continued progress in Indicators 4, 5, 6, 7, 8, 12, and 14 above, by the end of **Grade 12**, students:

15. Use discovery-oriented, inquiry-based, and problem-centered approaches to investigate and understand the mathematical content appropriate to the high school grades.
16. Recognize, formulate, and solve problems arising from mathematical situations, everyday experiences, applications to other disciplines, and career applications.
17. Monitor their own progress toward problem solutions.
18. Explore the validity and efficiency of various problem-posing and problem-solving strategies, and develop alternative strategies and generalizations as needed.

STANDARD 4.2	ALL STUDENTS WILL COMMUNICATE MATHEMATICALLY THROUGH WRITTEN, ORAL, SYMBOLIC, AND VISUAL FORMS OF EXPRESSION.
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Descriptive Statement: Communication of mathematical ideas will help students clarify and solidify their understanding of mathematics. By sharing their mathematical understandings in written and oral form with their classmates, teachers, and parents, students develop confidence in themselves as mathematics learners and enable teachers to better monitor their progress.

Cumulative Progress Indicators

By the end of **Grade 4**, students:

1. Discuss, listen, represent, read, and write as vital activities in their learning and use of mathematics.
2. Identify and explain key mathematical concepts, and model situations using oral, written, concrete, pictorial, and graphical methods.
3. Represent and communicate mathematical ideas through the use of learning tools such as calculators, computers, and manipulatives.
4. Engage in mathematical brainstorming and discussions by asking questions, making conjectures, and suggesting strategies for solving problems.
5. Explain their own mathematical work to others, and justify their reasoning and conclusions.

Building upon knowledge and skills gained in the preceding grades, and demonstrating continued progress in Indicators 1, 2, 3, 4, and 5 above, by the end of **Grade 8**, students:

6. Identify and explain key mathematical concepts and model situations using geometric and algebraic methods.
7. Use mathematical language and symbols to represent problem situations, and recognize the economy and power of mathematical symbolism and its role in the development of mathematics.
8. Analyze, evaluate, and explain mathematical arguments and conclusions presented by others.

Building upon knowledge and skills gained in the preceding grades, and demonstrating continued progress in Indicators 1, 2, 3, 4, 5, 6, 7, and 8 above, by the end of **Grade 12**, students:

9. Formulate questions, conjectures, and generalizations about data, information, and problem situations.
10. Reflect on and clarify their thinking so as to present convincing arguments for their conclusions.

STANDARD 4.3	ALL STUDENTS WILL CONNECT MATHEMATICS TO OTHER LEARNING BY UNDERSTANDING THE INTERRELATIONSHIPS OF MATHEMATICAL IDEAS AND THE ROLES THAT MATHEMATICS AND MATHEMATICAL MODELING PLAY IN OTHER DISCIPLINES AND IN LIFE.
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Descriptive Statement: Making connections enables students to see relationships between different topics, and to draw on those relationships in future study. This applies within mathematics, so that students can translate readily between fractions and decimals, or between algebra and geometry; to other content areas, so that students understand how mathematics is used in the sciences, the social sciences, and the arts; and to the everyday world, so that students can connect school mathematics to daily life.

Cumulative Progress Indicators

By the end of **Grade 4**, students:

1. View mathematics as an integrated whole rather than as a series of disconnected topics and rules.
2. Relate mathematical procedures to their underlying concepts.
3. Use models, calculators, and other mathematical tools to demonstrate the connections among various equivalent graphical, concrete, and verbal representations of mathematical concepts.
4. Explore problems and describe and confirm results using various representations.
5. Use one mathematical idea to extend understanding of another.
6. Recognize the connections between mathematics and other disciplines, and apply mathematical thinking and problem solving in those areas.
7. Recognize the role of mathematics in their daily lives and in society.

Building upon knowledge and skills gained in the preceding grades, and demonstrating continued progress in Indicators 1, 2, 3, and 4 above, by the end of **Grade 8**, students:

8. Recognize and apply unifying concepts and processes which are woven throughout mathematics.
9. Use the process of mathematical modeling in mathematics and other disciplines, and demonstrate understanding of its methodology, strengths, and limitations.
10. Apply mathematics in their daily lives and in career-based contexts.
11. Recognize situations in other disciplines in which mathematical models may be applicable, and apply appropriate models, mathematical reasoning, and problem solving to those situations.

Building upon knowledge and skills gained in the preceding grades, and demonstrating continued progress in Indicators 1, 2, 3, 8, 9, 10 and 11 above, by the end of **Grade 12**, students:

12. Recognize how mathematics responds to the changing needs of society, through the study of the history of mathematics.

STANDARD 4.4**ALL STUDENTS WILL DEVELOP REASONING ABILITY AND WILL
BECOME SELF-RELIANT, INDEPENDENT MATHEMATICAL
THINKERS**

Descriptive Statement: Mathematical reasoning is the critical skill that enables a student to make use of all other mathematical skills. With the development of mathematical reasoning, students recognize that mathematics makes sense and can be understood. They learn how to evaluate situations, select problem-solving strategies, draw logical conclusions, develop and describe solutions, and recognize how those solutions can be applied. Mathematical reasoners are able to reflect on solutions to problems and determine whether or not they make sense. They appreciate the pervasive use and power of reasoning as a part of mathematics.

Cumulative Progress Indicators

By the end of Grade 4, students:

1. Make educated guesses and test them for correctness.
2. Draw logical conclusions and make generalizations.
3. Use models, known facts, properties, and relationships to explain their thinking.
4. Justify answers and solution processes in a variety of problems.
5. Analyze mathematical situations by recognizing and using patterns and relationships.

Building upon knowledge and skills gained in the preceding grades, and demonstrating continued progress in Indicators 2, 3, and 5 above, by the end of Grade 8, students:

6. Make conjectures based on observation and information, and test mathematical conjectures and arguments.
7. Justify, in clear and organized form, answers and solution processes in a variety of problems.
8. Follow and construct logical arguments, and judge their validity.
9. Recognize and use deductive and inductive reasoning in all areas of mathematics.
10. Utilize mathematical reasoning skills in other disciplines and in their lives.
11. Use reasoning rather than relying on an answer-key to check the correctness of solutions to problems.

Building upon knowledge and skills gained in the preceding grades, and especially demonstrating continued progress in Indicators 2, 5, 8, 9, 10, and 11 above, by the end of **Grade 12**, students:

12. Make conjectures based on observation and information, and test mathematical conjectures, arguments, and proofs.
13. Formulate counter-examples to disprove an argument.

STANDARD 4.5

ALL STUDENTS WILL REGULARLY AND ROUTINELY USE CALCULATORS, COMPUTERS, MANIPULATIVES, AND OTHER MATHEMATICAL TOOLS TO ENHANCE MATHEMATICAL THINKING, UNDERSTANDING, AND POWER.

Descriptive Statement: Calculators, computers, manipulatives, and other mathematical tools need to be used by students in both instructional and assessment activities. These tools should be used, not to replace mental math and paper-and-pencil computational skills, but to enhance understanding of mathematics and the power to use mathematics. Historically, people have developed and used manipulatives (such as fingers, base ten blocks, geoboards, and algebra tiles) and mathematical devices (such as protractors, coordinate systems, and calculators) to help them understand and develop mathematics. Students should explore both new and familiar concepts with calculators and computers, but should also become proficient in using technology as it is used by adults, that is, for assistance in solving real-world problems.

Cumulative Progress Indicators

By the end of Grade 4, students:

1. Select and use calculators, software, manipulatives, and other tools based on their utility and limitations and on the problem situation.
2. Use physical objects and manipulatives to model problem situations, and to develop and explain mathematical concepts involving number, space, and data.
3. Use a variety of technologies to discover number patterns, demonstrate number sense, and visualize geometric objects and concepts.
4. Use a variety of tools to measure mathematical and physical objects in the world around them.
5. Use technology to gather, analyze, and display mathematical data and information.

Building upon knowledge and skills gained in the preceding grades, and demonstrating continued progress in Indicators 1, 2, 3, 4, and 5 above, by the end of Grade 8, students:

6. Use a variety of technologies to evaluate and validate problem solutions, and to investigate the properties of functions and their graphs.
7. Use computer spreadsheets and graphing programs to organize and display quantitative information and to investigate properties of functions.

Building upon knowledge and skills gained in the preceding grades, and demonstrating continued progress in Indicators 1, 2, 3, 5, and 7 above, by the end of Grade 12, students:

8. Use calculators and computers effectively and efficiently in applying mathematical concepts and principles to various types of problems.

STANDARD 4.6	ALL STUDENTS WILL DEVELOP NUMBER SENSE AND AN ABILITY TO REPRESENT NUMBERS IN A VARIETY OF FORMS AND USE NUMBERS IN DIVERSE SITUATIONS.
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Descriptive Statement: Number sense is defined as an intuitive feel for numbers and a common sense approach to using them. It is a comfort with what numbers represent, coming from investigating their characteristics and using them in diverse situations. It involves an understanding of how different types of numbers, such as fractions and decimals, are related to each other, and how they can best be used to describe a particular situation. Number sense is an attribute of all successful users of mathematics.

Cumulative Progress Indicators

By the end of Grade 4, students:

1. Use real-life experiences, physical materials, and technology to construct meanings for whole numbers, commonly used fractions, and decimals.
2. Develop an understanding of place value concepts and numeration in relationship to counting and grouping.
3. See patterns in number sequences, and use pattern-based thinking to understand extensions of the number system.
4. Develop a sense of the magnitudes of whole numbers, commonly used fractions, and decimals.
5. Understand the various uses of numbers including counting, measuring, labeling, and indicating location.
6. Count and perform simple computations with money.
7. Use models to relate whole numbers, commonly used fractions, and decimals to each other, and to represent equivalent forms of the same number.
8. Compare and order whole numbers, commonly used fractions, and decimals.
9. Explore real-life settings which give rise to negative numbers.

Building upon knowledge and skills gained in the preceding grades, by the end of Grade 8, students:

10. Understand money notations, count and compute money, and recognize the decimal nature of United States currency.
11. Extend their understanding of the number system by constructing meanings for integers, rational numbers, percents, exponents, roots, absolute values, and numbers represented in scientific notation.

12. Develop number sense necessary for estimation.
13. Expand the sense of magnitudes of different number types to include integers, rational numbers, and roots.
14. Understand and apply ratios, proportions, and percents in a variety of situations.
15. Develop and use order relations for integers and rational numbers.
16. Recognize and describe patterns in both finite and infinite number sequences involving whole numbers, rational numbers, and integers.
17. Develop and apply number theory concepts, such as primes, factors, and multiples, in real-world and mathematical problem situations.
18. Investigate the relationships among fractions, decimals, and percents, and use all of them appropriately.
19. Identify, derive, and compare properties of numbers.

Building upon knowledge and skills gained in the preceding grades, by the end of Grade 12, students:

20. Extend their understanding of the number system to include real numbers and an awareness of other number systems.
21. Develop conjectures and informal proofs of properties of number systems and sets of numbers.
22. Extend their intuitive grasp of number relationships, uses, and interpretations, and develop an ability to work with rational and irrational numbers.
23. Explore a variety of infinite sequences and informally evaluate their limits.

STANDARD 4.7

ALL STUDENTS WILL DEVELOP SPATIAL SENSE AND AN ABILITY TO USE GEOMETRIC PROPERTIES AND RELATIONSHIPS TO SOLVE PROBLEMS IN MATHEMATICS AND IN EVERYDAY LIFE.

Descriptive Statement: Spatial sense is an intuitive feel for shape and space. It involves the concepts of traditional geometry, including an ability to recognize, visualize, represent, and transform geometric shapes. It also involves other, less formal ways of looking at two- and three-dimensional space, such as paper-folding, transformations, tessellations, and projections. Geometry is all around us in art, nature, and the things we make. Students of geometry can apply their spatial sense and knowledge of the properties of shapes and space to the real world.

Cumulative Progress Indicators

By the end of Grade 4, students:

1. Explore spatial relationships such as the direction, orientation, and perspectives of objects in space, their relative shapes and sizes, and the relations between objects and their shadows or projections.
2. Explore relationships among shapes, such as congruence, symmetry, similarity, and self-similarity.
3. Explore properties of three- and two-dimensional shapes using concrete objects, drawings, and computer graphics.
4. Use properties of three- and two-dimensional shapes to identify, classify, and describe shapes.
5. Investigate and predict the results of combining, subdividing, and changing shapes.
6. Use tessellations to explore properties of geometric shapes and their relationships to the concepts of area and perimeter.
7. Explore geometric transformations such as rotations (turns), reflections (flips), and translations (slides).
8. Develop the concepts of coordinates and paths, using maps, tables, and grids.
9. Understand the variety of ways in which geometric shapes and objects can be measured.
10. Investigate the occurrence of geometry in nature, art, and other areas.

Building upon knowledge and skills gained in the preceding grades, by the end of Grade 8, students:

11. Relate two-dimensional and three-dimensional geometry using shadows, perspectives, projections and maps.
12. Understand and apply the concepts of symmetry, similarity and congruence.

13. Identify, describe, compare, and classify plane and solid geometric figures.
14. Understand the properties of lines and planes, including parallel and perpendicular lines and planes, and intersecting lines and planes and their angles of incidence.
15. Explore the relationships among geometric transformations (translations, reflections, rotations, and dilations), tessellations (tilings), and congruence and similarity.
16. Develop, understand, and apply a variety of strategies for determining perimeter, area, surface area, angle measure, and volume.
17. Understand and apply the Pythagorean Theorem.
18. Explore patterns produced by processes of geometric change, relating iteration, approximation, and fractals.
19. Investigate, explore, and describe geometry in nature and real-world applications, using models, manipulatives, and appropriate technology.

Building upon knowledge and skills gained in the preceding grades, and demonstrating continued progress in Indicators 16 and 19 above, by the end of **Grade 12**, students:

20. Understand and apply properties involving angles, parallel lines, and perpendicular lines.
21. Analyze properties of three-dimensional shapes by constructing models and by drawing and interpreting two-dimensional representations of them.
22. Use transformations, coordinates, and vectors to solve problems in Euclidean geometry.
23. Use basic trigonometric ratios to solve problems involving indirect measurement.
24. Solve real-world and mathematical problems using geometric models.
25. Use inductive and deductive reasoning to solve problems and to present reasonable explanations of and justifications for the solutions.
26. Analyze patterns produced by processes of geometric change, and express them in terms of iteration, approximation, limits, self-similarity, and fractals.
27. Explore applications of other geometries in real-world contexts.

STANDARD 4.8	ALL STUDENTS WILL UNDERSTAND, SELECT, AND APPLY VARIOUS METHODS OF PERFORMING NUMERICAL OPERATIONS.
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Descriptive Statement: Numerical operations are an essential part of the mathematics curriculum. Students must be able to select and apply various computational methods, including mental math, estimation, paper-and-pencil techniques, and the use of calculators. Students must understand how to add, subtract, multiply, and divide whole numbers, fractions, and others kinds of numbers. With calculators that perform these operations quickly and accurately, however, the instructional emphasis now should be on understanding the meanings and uses of the operations, and on estimation and mental skills, rather than solely on developing paper-and-pencil skills.

Cumulative Progress Indicators

By the end of Grade 4, students:

1. Develop meaning for the four basic arithmetic operations by modeling and discussing a variety of problems.
2. Develop proficiency with and memorize basic number facts using a variety of fact strategies (such as "counting on" and "doubles").
3. Construct, use, and explain procedures for performing whole number calculations in the various methods of computation.
4. Use models to explore operations with fractions and decimals.
5. Use a variety of mental computation and estimation techniques.
6. Select and use appropriate computational methods from mental math, estimation, paper-and-pencil, and calculator methods, and check the reasonableness of results.
7. Understand and use relationships among operations and properties of operations.

Building upon knowledge and skills gained in the preceding grades, and demonstrating continued progress in Indicator 6 above, by the end of Grade 8, students:

8. Extend their understanding and use of arithmetic operations to fractions, decimals, integers, and rational numbers.
9. Extend their understanding of basic arithmetic operations on whole numbers to include powers and roots.
10. Develop, apply, and explain procedures for computation and estimation with whole numbers, fractions, decimals, integers, and rational numbers.
11. Develop, apply, and explain methods for solving problems involving proportions and percents.
12. Understand and apply the standard algebraic order of operations.

Building upon knowledge and skills gained in the preceding grades, and demonstrating continued progress in Indicator 6 above, by the end of **Grade 12**, students:

13. Extend their understanding and use of operations to real numbers and algebraic procedures.
14. Develop, apply, and explain methods for solving problems involving factorials, exponents, and matrices.

STANDARD 4.9**ALL STUDENTS WILL DEVELOP AN UNDERSTANDING OF AND WILL USE MEASUREMENT TO DESCRIBE AND ANALYZE PHENOMENA.**

Descriptive Statement: Measurement helps describe our world using numbers. We use numbers to describe simple things like length, weight, and temperature, but also complex things such as pressure, speed, and brightness. An understanding of how we attach numbers to those phenomena, familiarity with common measurement units like inches, liters, and miles per hour, and a practical knowledge of measurement tools and techniques are critical for students' understanding of the world around them.

Cumulative Progress Indicators

By the end of Grade 4, students:

1. Use and describe measures of length, distance, capacity, weight, area, volume, time, and temperature.
2. Compare and order objects according to some measurable attribute.
3. Recognize the need for a uniform unit of measure.
4. Develop and use personal referents for standard units of measure (such as the width of a finger to approximate a centimeter).
5. Select and use appropriate standard and non-standard units of measurement to solve real-life problems.
6. Understand and incorporate estimation and repeated measures in measurement activities.

Building upon knowledge and skills gained in the preceding grades, by the end of Grade 8, students:

7. Use estimated and actual measurements to describe and compare phenomena.
8. Read and interpret various scales, including those based on number lines and maps.
9. Determine the degree of accuracy needed in a given situation and choose units accordingly.
10. Understand that all measurements of continuous quantities are approximate.
11. Develop formulas and procedures for solving problems related to measurement.
12. Explore situations involving quantities which cannot be measured directly or conveniently.
13. Convert measurement units from one form to another, and carry out calculations that involve various units of measurement.
14. Understand and apply measurement in their own lives and in other subject areas.

15. Understand and explain the impact of the change of an object's linear dimensions on its perimeter, area, or volume.
16. Apply their knowledge of measurement to the construction of a variety of two- and three-dimensional figures.

Building upon knowledge and skills gained in the preceding grades, by the end of **Grade 12**, students:

17. Use techniques of algebra, geometry, and trigonometry to measure quantities indirectly.
18. Use measurement appropriately in other subject areas and career-based contexts.
19. Choose appropriate techniques and tools to measure quantities in order to achieve specified degrees of precision, accuracy, and error (or tolerance) of measurements.

STANDARD 4.10	ALL STUDENTS WILL USE A VARIETY OF ESTIMATION STRATEGIES AND RECOGNIZE SITUATIONS IN WHICH ESTIMATION IS APPROPRIATE.
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Descriptive Statement: Estimation is a process that is used constantly by mathematically capable adults, and that can be mastered easily by children. It involves an educated guess about a quantity or a measure, or an intelligent prediction of the outcome of a computation. The growing use of calculators makes it more important than ever that students know when a computed answer is reasonable; the best way to make that decision is through estimation. Equally important is an awareness of the many situations in which an approximate answer is as good as, or even preferable to, an exact answer.

Cumulative Progress Indicators

By the end of **Grade 4**, students:

1. Judge without counting whether a set of objects has less than, more than, or the same number of objects as a reference set.
2. Use personal referents, such as the width of a finger as one centimeter, for estimations with measurement.
3. Visually estimate length, area, volume, or angle measure.
4. Explore, construct, and use a variety of estimation strategies.
5. Recognize when estimation is appropriate, and understand the usefulness of an estimate as distinct from an exact answer.
6. Determine the reasonableness of an answer by estimating the result of operations.
7. Apply estimation in working with quantities, measurement, time, computation, and problem solving.

Building upon knowledge and skills gained in the preceding grades, and demonstrating continued progress in Indicators 5 and 6 above, by the end of **Grade 8**, students:

8. Develop, apply, and explain a variety of different estimation strategies in problem situations involving quantities and measurement.
9. Use equivalent representations of numbers such as fractions, decimals, and percents to facilitate estimation.
10. Determine whether a given estimate is an overestimate or an underestimate.

Building upon knowledge and skills gained in the preceding grades, and demonstrating continued progress in Indicator 6 above, by the end of **Grade 12**, students:

11. Estimate probabilities and predict outcomes from real-world data.
12. Recognize the limitations of estimation, assess the amount of error resulting from estimation, and determine whether the error is within acceptable tolerance limits.

STANDARD 4.11	ALL STUDENTS WILL DEVELOP AN UNDERSTANDING OF PATTERNS, RELATIONSHIPS, AND FUNCTIONS AND WILL USE THEM TO REPRESENT AND EXPLAIN REAL-WORLD PHENOMENA.
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Descriptive Statement: Patterns, relationships, and functions constitute a unifying theme of mathematics. From the earliest age, students should be encouraged to investigate the patterns that they find in numbers, shapes, and expressions, and, by doing so, to make mathematical discoveries. They should have opportunities to analyze, extend, and create a variety of patterns and to use pattern-based thinking to understand and represent mathematical and other real-world phenomena. These explorations present unlimited opportunities for problem-solving, making and verifying generalizations, and building mathematical understanding and confidence.

Cumulative Progress Indicators

By the end of **Grade 4**, students:

1. Reproduce, extend, create, and describe patterns and sequences using a variety of materials.
2. Use tables, rules, variables, open sentences, and graphs to describe patterns and other relationships.
3. Use concrete and pictorial models to explore the basic concept of a function.
4. Observe and explain how a change in one physical quantity can produce a corresponding change in another.
5. Observe and recognize examples of patterns, relationships, and functions in other disciplines and contexts.
6. Form and verify generalizations based on observations of patterns and relationships.

Building upon knowledge and skills gained in the preceding grades, by the end of **Grade 8**, students:

7. Represent and describe mathematical relationships with tables, rules, simple equations, and graphs.
8. Understand and describe the relationships among various representations of patterns and functions.
9. Use patterns, relationships, and functions to model situations and to solve problems in mathematics and in other subject areas.
10. Analyze functional relationships to explain how a change in one quantity results in a change in another.

11. Understand and describe the general behavior of functions.
12. Use patterns, relationships, and linear functions to model situations in mathematics and in other areas.
13. Develop, analyze, and explain arithmetic sequences.

Building upon knowledge and skills gained in the preceding grades, by the end of **Grade 12**, students:

14. Analyze and describe how a change in an independent variable can produce a change in a dependent variable.
15. Use polynomial, rational, trigonometric, and exponential functions to model real-world phenomena.
16. Recognize that a variety of phenomena can be modeled by the same type of function.
17. Analyze and explain the general properties and behavior of functions, and use appropriate graphing technologies to represent them.
18. Analyze the effects of changes in parameters on the graphs of functions.
19. Understand the role of functions as a unifying concept in mathematics.

STANDARD 4.12	ALL STUDENTS WILL DEVELOP AN UNDERSTANDING OF STATISTICS AND PROBABILITY AND WILL USE THEM TO DESCRIBE SETS OF DATA, MODEL SITUATIONS, AND SUPPORT APPROPRIATE INFERENCES AND ARGUMENTS.
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Descriptive Statement: Probability and statistics are the mathematics used to understand chance and to collect, organize, describe, and analyze numerical data. From weather reports to sophisticated studies of genetics, from election results to product preference surveys, probability and statistical language and concepts are increasingly present in the media and in everyday conversations. Students need this mathematics to help them judge the correctness of an argument supported by seemingly persuasive data.

Cumulative Progress Indicators

By the end of Grade 4, students:

1. Formulate and solve problems that involve collecting, organizing, and analyzing data.
2. Generate and analyze data obtained using chance devices such as spinners and dice.
3. Make inferences and formulate hypotheses based on data.
4. Understand and informally use the concepts of range, mean, mode, and median.
5. Construct, read, and interpret displays of data such as pictographs, bar graphs, circle graphs, tables, and lists.
6. Determine the probability of a simple event, assuming equally likely outcomes.
7. Make predictions that are based on intuitive, experimental, and theoretical probabilities.
8. Use concepts of certainty, fairness, and chance to discuss the probability of actual events.

Building upon knowledge and skills gained in the preceding grades, by the end of Grade 8, students:

9. Generate, collect, organize, and analyze data and represent this data in tables, charts, and graphs.
10. Select and use appropriate graphical representations and measures of central tendency (mean, mode and median) for sets of data.
11. Make inferences and formulate and evaluate arguments based on data analysis and data displays.
12. Use lines of best fit to interpolate and predict from data.
13. Determine the probability of a compound event.

14. Model situations involving probability, such as genetics, using both simulations and theoretical models.
15. Use models of probability to predict events based on actual data.
16. Interpret probabilities as ratios and percents.

Building upon knowledge and skills gained in the preceding grades, by the end of **Grade 12**, students:

17. Estimate probabilities and predict outcomes from actual data.
18. Understand sampling and recognize its role in statistical claims.
19. Evaluate bias, accuracy, and reasonableness of data in real-world contexts.
20. Understand and apply measures of dispersion and correlation.
21. Design a statistical experiment to study a problem, conduct the experiment, and interpret and communicate the outcomes.
22. Make predictions using curve fitting and numerical procedures to interpolate and extrapolate from known data.
23. Use relative frequency and probability, as appropriate, to represent and solve problems involving uncertainty.
24. Use simulations to estimate probabilities.
25. Create and interpret discrete and continuous probability distributions, and understand their application to real-world situations.
26. Describe the normal curve in general terms, and use its properties to answer questions about sets of data that are assumed to be normally distributed.
27. Understand and use the law of large numbers (that experimental results tend to approach theoretical probabilities after a large number of trials).

STANDARD 4.13

ALL STUDENTS WILL DEVELOP AN UNDERSTANDING OF ALGEBRAIC CONCEPTS AND PROCESSES AND WILL USE THEM TO REPRESENT AND ANALYZE RELATIONSHIPS AMONG VARIABLE QUANTITIES AND TO SOLVE PROBLEMS.

Descriptive Statement: Algebra is a language used to express mathematical relationships. Students need to understand how quantities are related to one another, and how algebra can be used to concisely express and analyze those relationships. Modern technology provides tools for supplementing the traditional focus on algebraic techniques, such as solving equations, with a more visual perspective, with graphs of equations displayed on a screen. Students can then focus on understanding the relationship between the equation and the graph, and on what the graph represents in a real-life situation.

Cumulative Progress Indicators

By the end of Grade 4, students:

1. Understand and represent numerical situations using variables, expressions, and number sentences.
2. Represent situations and number patterns with concrete materials, tables, graphs, verbal rules, and number sentences, and translate from one to another.
3. Understand and use properties of operations and numbers.
4. Construct and solve open sentences (example: $3 + \underline{\quad} = 7$) that describe real-life situations.

Building upon knowledge and skills gained in the preceding grades, by the end of Grade 8, students:

5. Understand and use variables, expressions, equations, and inequalities.
6. Represent situations and number patterns with concrete materials, tables, graphs, verbal rules, and standard algebraic notation.
7. Use graphing techniques on a number line to model both absolute value and arithmetic operations.
8. Analyze tables and graphs to identify properties and relationships.
9. Understand and use the rectangular coordinate system.
10. Solve simple linear equations using concrete, informal, and graphical methods, as well as appropriate paper-and-pencil techniques.
11. Explore linear equations through the use of calculators, computers, and other technology.

12. Investigate inequalities and nonlinear equations informally.
13. Draw freehand sketches of, and interpret, graphs which model real phenomena.

Building upon knowledge and skills gained in the preceding grades, by the end of **Grade 12**, students:

14. Model and solve problems that involve varying quantities using variables, expressions, equations, inequalities, absolute values, vectors, and matrices.
15. Use tables and graphs as tools to interpret expressions, equations, and inequalities.
16. Develop, explain, use, and analyze procedures for operating on algebraic expressions and matrices.
17. Solve equations and inequalities of varying degrees using graphing calculators and computers as well as appropriate paper-and-pencil techniques.
18. Understand the logic and purposes of algebraic procedures.
19. Interpret algebraic equations and inequalities geometrically, and describe geometric objects algebraically.

STANDARD 4.14	ALL STUDENTS WILL APPLY THE CONCEPTS AND METHODS OF DISCRETE MATHEMATICS TO MODEL AND EXPLORE A VARIETY OF PRACTICAL SITUATIONS.
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Descriptive Statement: Discrete mathematics is the branch of mathematics that deals with arrangements of distinct objects. It includes a wide variety of topics and techniques that arise in everyday life, such as how to find the best route from one city to another, where the objects are cities arranged on a map. It also includes how to count the number of different combinations of toppings for pizzas, how best to schedule a list of tasks to be done, and how computers store and retrieve arrangements of information on a screen. Discrete mathematics is the mathematics used by decision-makers in our society, from workers in government to those in health care, transportation, and telecommunications. Its various applications help students see the relevance of mathematics in the real world.

Cumulative Progress Indicators

By the end of Grade 4, students:

1. Explore a variety of puzzles, games, and counting problems.
2. Use networks and tree diagrams to represent everyday situations.
3. Identify and investigate sequences and patterns found in nature, art, and music.
4. Investigate ways to represent and classify data according to attributes, such as shape or color, and relationships, and discuss the purpose and usefulness of such classification.
5. Follow, devise, and describe practical lists of instructions.

Building upon knowledge and skills gained in the preceding grades, by the end of Grade 8, students:

6. Use systematic listing, counting, and reasoning in a variety of different contexts.
7. Recognize common discrete mathematical models, explore their properties, and design them for specific situations.
8. Experiment with iterative and recursive processes, with the aid of calculators and computers.
9. Explore methods for storing, processing, and communicating information.
10. Devise, describe, and test algorithms for solving optimization and search problems.

Building upon knowledge and skills gained in the preceding grades, by the end of Grade 12, students:

11. Understand the basic principles of iteration, recursion, and mathematical induction.
12. Use basic principles to solve combinatorial and algorithmic problems.
13. Use discrete models to represent and solve problems.
14. Analyze iterative processes with the aid of calculators and computers.
15. Apply discrete methods to storing, processing, and communicating information.
16. Apply discrete methods to problems of voting, apportionment, and allocations, and use fundamental strategies of optimization to solve problems.

STANDARD 4.15

ALL STUDENTS WILL DEVELOP AN UNDERSTANDING OF THE CONCEPTUAL BUILDING BLOCKS OF CALCULUS AND WILL USE THEM TO MODEL AND ANALYZE NATURAL PHENOMENA.

Descriptive Statement: The conceptual building blocks of calculus are important for everyone to understand. How quantities such as world population change, how fast they change, and what will happen if they keep changing at the same rate are questions that can be discussed by elementary school students. Another important topic for all mathematics students is the concept of infinity - what happens as numbers get larger and larger and what happens as patterns are continued indefinitely. Early explorations in these areas can broaden students' interest in and understanding of an important area of applied mathematics.

Cumulative Progress Indicators

By the end of Grade 4, students:

1. Investigate and describe patterns that continue indefinitely.
2. Investigate and describe how certain quantities change over time.
3. Experiment with approximating length, area, and volume, using informal measurement instruments.

Building upon knowledge and skills gained in the preceding grades, by the end of Grade 8, students:

4. Recognize and express the difference between linear and exponential growth.
5. Develop an understanding of infinite sequences that arise in natural situations.
6. Investigate, represent, and use non-terminating decimals.
7. Represent, analyze, and predict relations between quantities, especially quantities changing over time.
8. Approximate quantities with increasing degrees of accuracy.
9. Understand and use the concept of significant digits.
10. Develop informal ways of approximating the surface area and volume of familiar objects, and discuss whether the approximations make sense.
11. Express mathematically and explain the impact of the change of an object's linear dimensions on its surface area and volume.

Building upon knowledge and skills gained in the preceding grades, by the end of **Grade 12**, students:

12. Develop and use models based on sequences and series.
13. Develop and apply procedures for finding the sum of finite arithmetic series and of finite and infinite geometric series.
14. Develop an informal notion of limit.
15. Use linear, quadratic, trigonometric, and exponential models to explain growth and change in the natural world.
16. Recognize fundamental mathematical models (such as polynomial, exponential, and trigonometric functions) and apply basic translations, reflections, and dilations to their graphs.
17. Develop and explain the concept of the slope of a curve and use that concept to discuss the information contained in graphs.
18. Develop an understanding of the concept of continuity of a function.
19. Understand and apply approximation techniques to situations involving initial portions of infinite decimals and measurement.

STANDARD 4.16 ALL STUDENTS WILL DEMONSTRATE HIGH LEVELS OF MATHEMATICAL THOUGHT THROUGH EXPERIENCES WHICH EXTEND BEYOND TRADITIONAL COMPUTATION, ALGEBRA, AND GEOMETRY.

Descriptive Statement: High expectations for all students form a critical part of the learning environment. The belief of teachers, administrators, and parents that a student can and will succeed in mathematics often makes it possible for that student to succeed. Beyond that, this standard calls for a commitment that all students will be continuously challenged and enabled to go as far mathematically as they can.

Cumulative Progress Indicators

By the end of Grade 12, students:

1. Study a core curriculum containing challenging ideas and tasks, rather than one limited to repetitive, low-level cognitive activities.
2. Work at rich, open-ended problems which require them to use mathematics in meaningful ways, and which provide them with exciting and interesting mathematical experiences.
3. Recognize mathematics as integral to the development of all cultures and civilizations, and in particular to that of our own society.
4. Understand the important role that mathematics plays in their own success, regardless of career.
5. Interact frequently with parents and other members of their communities, including men and women from a variety of cultural backgrounds, who use mathematics in their daily lives and occupations.
6. Receive services that help them understand the mathematical skills and concepts necessary to assure success in the core curriculum.
7. Receive equitable treatment without regard to gender, ethnicity, or predetermined expectations for success.
8. Learn mathematics in classes which reflect the diversity of the school's total student population.
9. Be provided with opportunities at all grade levels for further study of mathematics, especially including topics beyond traditional computation, algebra, and geometry.
10. Be challenged to maximize their mathematical achievements at all grade levels.
11. Experience a full program of meaningful mathematics so that they can pursue post-secondary education.

1. The first part of the report discusses the general situation of the company and the results of the survey. It also mentions the objectives of the study and the methods used.

2. The second part of the report describes the findings of the survey. It includes a detailed analysis of the data collected and a comparison with the previous year's results. The findings are presented in a clear and concise manner, with the use of tables and graphs where appropriate.

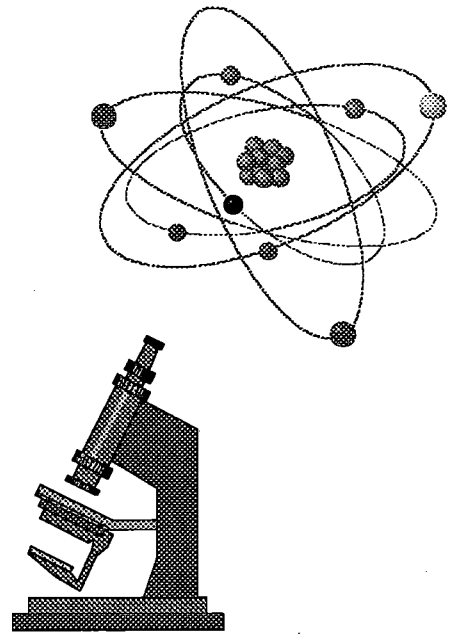
3. The third part of the report discusses the conclusions drawn from the survey. It highlights the main points of the findings and provides recommendations for future action. The conclusions are based on a thorough analysis of the data and a consideration of the company's overall performance.

4. The fourth part of the report provides a summary of the findings and conclusions. It also includes a list of references and a bibliography. The summary is a brief overview of the entire report, highlighting the key points and findings.

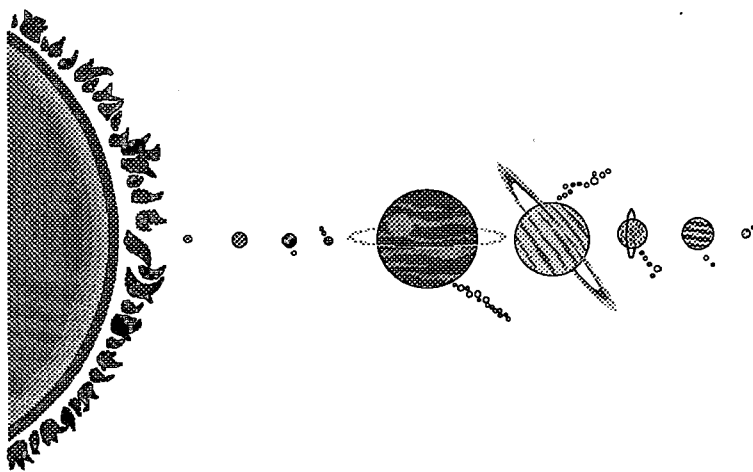
5. The fifth part of the report is a conclusion. It summarizes the main findings of the survey and provides recommendations for future action. The conclusion is based on a thorough analysis of the data and a consideration of the company's overall performance.

6. The sixth part of the report is a list of references. It includes a list of books, articles, and other sources used in the report. The references are listed in a standard format, making it easy for the reader to find the sources.

7. The seventh part of the report is a list of appendices. It includes a list of tables, figures, and other supplementary material. The appendices are listed in a standard format, making it easy for the reader to find the material.



SCIENCE





New Jersey Core Curriculum Content Standards for Science

Introduction

The New Jersey core curriculum content standards for Science reflect the belief that all students can and must learn enough science to assume their role as concerned citizens equipped with necessary information and decision-making skills.

The need for scientific literacy in today's increasingly technological world, for fundamental reforms in how science is taught, and for established standards in science education are by now well-known and documented. Presidential appeals for excellence, combined with expressions of concern from scientists and educators, have led to national, state, and local initiatives. New Jersey is host to an impressive array of scientific and technological industries, and should play a leadership role in the development and implementation of standards for the teaching and learning of science.

From the outset, the core curriculum content standards for Science were influenced by certain understandings, events, and principles in the continuing improvement of science education in New Jersey and the nation. Efforts to establish standards for the teaching and learning of science have been pursued actively at the state and national level. In 1993, Benchmarks for Science Literacy was published by the American Association for the Advancement of Science, followed in 1994 by a comprehensive draft of the National Science Education Standards by the National Research Council. Both these documents contributed to an ongoing interest in the formulation of world class educational standards rooted in reform movements such as Project 2061 of the American Association for the Advancement of Science, and the Scope, Sequence and Coordination Project of the National Science Teachers Association. The simultaneously emerging national standards presented a reliable model that was often consulted in the formulation of these standards.

In New Jersey, the call for science education standards was heightened when the State was awarded a grant from the National Science Foundation for the establishment of a Statewide Systematic Initiative for the reform of mathematics, science, and technology education. The combined funding of the NJ SSI and the Mid-Atlantic Eisenhower Consortium for Math and Science Education made possible the widespread distribution of an initial draft of science standards during school year 1994-95.

An enormous amount of scientific content has accumulated at an accelerating rate over the years, causing textbooks to thicken as material is added but rarely deleted. Science educators across the nation have come to recognize this as a disturbing and counterproductive trend. The Science Standards in this section, therefore, are not intended to include all of science, but rather are an attempt to define what all students should know and be able to do as they grow towards scientific literacy. A guiding principle of these standards is that an understanding of fundamental scientific principles and the development of science-related skills are not limited by gender, economic status, cultural background, or ability. While we recognize the need for the inclusion of fundamental understandings in the life, earth, and physical sciences, the development of critical thinking skills is considered of paramount importance. Also important are the attitudes that students display as they learn science, and the development of qualities inherent in the practice of science, such as curiosity, skepticism, open-mindedness, and honesty when collecting and interpreting findings. While these habits of mind cannot be measured easily, no science program can be considered complete or successful that does not promote them.

Science should be taught at all levels with awareness of its connection to other subjects and the needs of society. While these standards do not suggest a specific curriculum design or sequence of courses, they assume that the relationship of the various disciplines of science to each other, and of science to the overall learning experience, will be strongly emphasized. The standards also reflect the needs of the students and teachers of New Jersey; indeed, incorporating New Jersey's unique natural resources in the teaching of science should be a primary goal of school districts as they move towards implementation.

The formulation of standards does not insure their proper implementation. The national initiative mentioned above includes standards that address the preparation of science teachers as well as the school environment in which science is taught. While this document is not intended to deal with such issues, they have informed the development of these standards and must be considered if the standards are to be realized. The standards can only be of value as part of a larger, ongoing effort to improve the teaching and learning of science in New Jersey schools. Defining scientific literacy for the citizens of New Jersey and the nation is an important first step toward achieving this goal.

References

American Association for the Advancement of Science. (1993). Benchmarks for science literacy.

American Association for the Advancement of Science. (1989). Project 2061. New York.

National Research Council. (1994). National science education standard.

National Science Teachers Association. (1992). Scope, sequence and coordination of secondary school science, vol. 1. Washington, DC.

SCIENCE LIST OF STANDARDS

- 5.1 All students will learn to identify systems of interacting components and understand how their interactions combine to produce the overall behavior of the system.
- 5.2 All students will develop problem-solving, decision-making and inquiry skills, reflected by formulating usable questions and hypotheses, planning experiments, conducting systematic observations, interpreting and analyzing data, drawing conclusions, and communicating results.
- 5.3 All students will develop an understanding of how people of various cultures have contributed to the advancement of science and technology, and how major discoveries and events have advanced science and technology.
- 5.4 All students will develop an understanding of technology as an application of scientific principles.
- 5.5 All students will integrate mathematics as a tool for problem-solving in science, and as a means of expressing and/or modeling scientific theories.
- 5.6 All students will gain an understanding of the structure, characteristics, and basic needs of organisms.
- 5.7 All students will investigate the diversity of life.
- 5.8 All students will gain an understanding of the structure and behavior of matter.
- 5.9 All students will gain an understanding of natural laws as they apply to motion, forces, and energy transformations.
- 5.10 All students will gain an understanding of the structure, dynamics, and geophysical systems of the earth.
- 5.11 All students will gain an understanding of the origin, evolution, and structure of the universe.
- 5.12 All students will develop an understanding of the environment as a system of interdependent components affected by human activity and natural phenomena.

**SCIENCE
STANDARDS AND PROGRESS INDICATORS**

STANDARD 5.1	ALL STUDENTS WILL LEARN TO IDENTIFY SYSTEMS OF INTERACTING COMPONENTS AND UNDERSTAND HOW THEIR INTERACTIONS COMBINE TO PRODUCE THE OVERALL BEHAVIOR OF THE SYSTEM.
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Descriptive Statement: The natural world and the world built by humans both provide examples of systems where interacting parts work together as a whole. This standard asks students to analyze, understand, and design systems of integrating parts.

Cumulative Progress Indicators

By the end of **Grade 4**, students:

1. Recognize that most things are made of components that, when assembled, can do things they could not do separately.
2. Recognize that since the components of a system usually influence one another, a system may not work if a component is missing.
3. Diagram the components of a system.

Building upon knowledge and skills gained in the preceding grades, by the end of **Grade 8**, students:

4. Describe components of a system and how they influence one another.
5. Recognize that most systems are components of larger systems and that the output of one component can become the input to other components.
6. Disassemble and reassemble the components of a system, analyzing how they interact with each other.

Building upon knowledge and skills gained in the preceding grades, by the end of **Grade 12**, students:

7. Recognize that the behavior of a system may be different from the behavior of its components.
8. Explain how feedback can be used to control the behavior of a system.
9. Identify and diagram feedback loops that occur in biological or ecological systems.
10. Identify and diagram feedback loops designed for common control systems, such as home light switches and thermostats.

STANDARD 5.2 ALL STUDENTS WILL DEVELOP PROBLEM-SOLVING, DECISION-MAKING, AND INQUIRY SKILLS, REFLECTED BY FORMULATING USABLE QUESTIONS AND HYPOTHESES, PLANNING EXPERIMENTS, CONDUCTING SYSTEMATIC OBSERVATIONS, INTERPRETING AND ANALYZING DATA, DRAWING CONCLUSIONS, AND COMMUNICATING RESULTS.

Descriptive Statement: Students best learn science by doing science. Science is not merely a collection of facts and theories but a process, a way of thinking about and investigating the world in which we live. This standard addresses those skills that are used by scientists as they discover and explain the physical universe - skills that are an essential and ongoing part of learning science.

Cumulative Progress Indicators

By the end of **Grade 4**, students:

1. State a problem about the natural world in the form of a question.
2. Develop strategies and skills for information-gathering and problem-solving, using appropriate tools and technologies.
3. Use technology to present the design and results of investigation.
4. Keep a journal record of observations, recognizing patterns of observations and summarizing findings.
5. Learn what constitutes evidence and evaluate the data and information used to make explanations.

Building upon knowledge and skills gained in the preceding grades, by the end of **Grade 8**, students:

6. Identify problems that can be solved by conducting experiments.
7. Design and conduct experiments incorporating the use of a control.
8. Collect and organize data to support the results of an experiment.
9. Communicate experimental findings using words, charts, graphs, pictures, and diagrams.
10. Evaluate the strengths and weaknesses of claims, arguments, and data.
11. Assess the risks and benefits associated with alternative actions.

Building upon knowledge and skills gained in the preceding grades, by the end of **Grade 12**, students:

12. Select and use appropriate instrumentation to design and conduct investigations.
13. Use technology to present the design and results of investigation.
14. Evaluate conclusions, weigh evidence, and recognize that arguments may not have equal merit.
15. Explain how experimental results lead to further investigation.

STANDARD 5.3 ALL STUDENTS WILL DEVELOP AN UNDERSTANDING OF HOW PEOPLE OF VARIOUS CULTURES HAVE CONTRIBUTED TO THE ADVANCEMENT OF SCIENCE AND TECHNOLOGY, AND HOW MAJOR DISCOVERIES AND EVENTS HAVE ADVANCED SCIENCE AND TECHNOLOGY.

Descriptive Statement: Science is a human endeavor involving successes and failures, trials and tribulations. Students should know that many people of all cultures have contributed to our understanding of science and that science has a rich and fascinating history. This standard encourages students to learn about the people and events that have shaped or revolutionized important scientific theories and concepts.

Cumulative Progress Indicators

By the end of **Grade 4**, students:

1. Hear, read, write, and talk about scientists and inventors in historical context.
2. Recognize that scientific ideas and knowledge have come from men and women of all cultures.

Building upon knowledge and skills gained in the preceding grades, by the end of **Grade 8**, students:

3. Recognize that scientific theories emerge over time, depend on the contributions of many people, and reflect the social and political climate of their time.
4. Develop a time line of major events and people in the history of science, in conjunction with other world events.
5. Trace the historical origin of important scientific developments such as atomic theory, genetics, plate tectonics, etc., showing how scientific theories emerge, are tested, and can be replaced or modified in light of new information and improved investigative techniques.

Building upon knowledge and skills gained in the preceding grades, by the end of **Grade 12**, students:

6. Recognize the role of the scientific community in responding to changing social and political conditions.
7. Examine the lives and contributions of important scientists and engineers who effected major breakthroughs in our understanding of the natural world.

STANDARD 5.4 ALL STUDENTS WILL DEVELOP AN UNDERSTANDING OF TECHNOLOGY AS AN APPLICATION OF SCIENTIFIC PRINCIPLES.
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Descriptive Statement: Understanding the unique interdependence of science and technology is an important goal of science education. This standard is an attempt to show students how the application of scientific knowledge can be used to improve the human condition and how technological development affects the quality of life.

Cumulative Progress Indicators

By the end of **Grade 4**, students:

1. Develop skill in the use of tools for everyday purposes.
2. Demonstrate how tools are used to do things better and more easily or to do tasks that could not otherwise be done.
3. Examine and compare toys and other familiar objects and explain how they work.
4. Find and report on examples of how technology helps people.

Building upon knowledge and skills gained in the preceding grades, by the end of **Grade 8**, students:

5. Describe how tools of today are different from those of the past but may be modifications of ancient tools.
6. Describe how technology expands the ability of scientists and others to make measurements and observations.
7. Design and build simple mechanical devices to demonstrate scientific principles.
8. Explain how engineers and others apply scientific knowledge to solve practical problems.
9. Compare the advantages and disadvantages of alternative solutions to practical problems.

Building upon knowledge and skills gained in the preceding grades, by the end of **Grade 12**, students:

10. Recognize that technological problems often create a demand for new scientific knowledge, and cite present and past examples of the interrelationship and mutual influence of science, technology, and society.
11. Participate in a design project that identifies a problem, proposes and implements a solution, and evaluates the consequences of that solution.

STANDARD 5.5	ALL STUDENTS WILL INTEGRATE MATHEMATICS AS A TOOL FOR PROBLEM-SOLVING IN SCIENCE, AND AS A MEANS OF EXPRESSING AND/OR MODELING SCIENTIFIC THEORIES.
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Descriptive Statement: Galileo is credited with asserting that "Mathematics is the language with which God wrote the Universe." Science cannot be practiced or learned without appreciation of the role of mathematics in discovering and expressing natural laws. This standard recognizes the need for students to fully integrate mathematics skills with their learning of science.

Cumulative Progress Indicators

By the end of **Grade 4**, students:

1. Judge whether estimates, measurements, and computations of quantities are reasonable.
2. Use a variety of measuring instruments, emphasizing appropriate units.
3. Use mathematical skills and concepts in ordering, counting, identifying, measuring, and describing.
4. Use tables and graphs to represent and interpret data.

Building upon knowledge and skills gained in the preceding grades, by the end of **Grade 8**, students:

5. Recognize and comprehend the orders of magnitude associated with large and small physical quantities.
6. Express experimental data in several equivalent forms such as integers, fractions, decimals, and percents.
7. Infer mathematical relationships among variables using graphs, tables, and charts.
8. Express the output units of the calculation in terms of the input units.
9. Select appropriate measuring instruments based on the degree of precision needed.
10. Find the mean and median of a set of experimental data.

Building upon knowledge and skills gained in the preceding grades, by the end of **Grade 12**, students:

11. Express the results of mathematical operations based on the degree of precision of the input data.
12. Use computer spreadsheets, graphing, and database programs to assist in quantitative analysis.

13. Evaluate the possible effects of measurement errors on calculations.
14. Express physical relationships in terms of mathematical equations derived from collected data.
15. Use mathematical models to predict physical phenomena.

STANDARD 5.6	ALL STUDENTS WILL GAIN AN UNDERSTANDING OF THE STRUCTURE, CHARACTERISTICS, AND BASIC NEEDS OF ORGANISMS.
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Descriptive Statement: The study of science must include the diversity, complexity, and interdependence of life on earth. Students should know how organisms evolve, reproduce, and adapt to their environments. Standards 5.6 and 5.7 serve to define the fundamental understandings of the life sciences.

Cumulative Progress Indicators

By the end of **Grade 4**, students:

1. Compare and contrast living and nonliving things.
2. Determine the basic needs of organisms.
3. Show that living things have different levels of organization.
4. Show that plants and animals are composed of different parts serving different purposes and working together for the well-being of the organism.
5. Describe life cycles of organisms.
6. Group organisms according to the functions they serve in a food chain.
7. Identify the major systems of the human body and explain how their functions are interrelated.

Building upon knowledge and skills gained in the preceding grades, by the end of **Grade 8**, students:

8. Describe and give examples of the major categories of living organisms and of the characteristics shared by organisms.
9. Recognize that complex multicellular organisms are interacting systems of cells, tissues, and organs.
10. Identify and describe the structure and function of cell parts.
11. Explain how organisms are affected by different components of an ecosystem and the flow of energy through it.
12. Illustrate and explain life cycles of organisms.

Building upon knowledge and skills gained in the preceding grades, by the end of **Grade 12**, students:

13. Identify and describe organisms that possess characteristics of living and nonliving things.
14. Identify and explain the structure and function of molecules that control cellular activities.
15. Explain how plants convert light energy to chemical energy.
16. Describe how plants produce substances high in energy content that become the primary source of energy for animal life.
17. Compare and contrast the life cycles of living things as they interact with ecosystems.

STANDARD 5.7 ALL STUDENTS WILL INVESTIGATE THE DIVERSITY OF LIFE.

Descriptive Statement: The study of science must include the diversity, complexity, and interdependence of life on earth. Students should know how organisms evolve, reproduce, and adapt to their environments. Standards 5.6 and 5.7 serve to define the fundamental understandings of the life sciences.

Cumulative Progress Indicators

By the end of **Grade 4**, students:

1. Recognize the diversity of plants and animals on earth.
2. Develop a simple classification scheme for grouping organisms.
3. Recognize that individuals vary within every species.
4. Identify and describe external features of plants and animals that help them survive in varied habitats.

Building upon knowledge and skills gained in the preceding grades, by the end of **Grade 8**, students:

5. Illustrate how the sorting and recombining of genetic material results in the potential for variation among offspring.
6. Compare and contrast acquired and inherited characteristics.
7. Classify organisms by their internal and external characteristics.
8. Discuss how changing environmental conditions can result in evolution of a species.
9. Recognize that individual organisms with certain traits are more likely to survive and have offspring.

Building upon knowledge and skills gained in the preceding grades, by the end of **Grade 12**, students:

10. Describe how information is encoded in genetic material.
11. Explain how DNA can be altered by natural or artificial means to produce permanent changes in a species.
12. Explain that through evolution the earth's present species developed from earlier distinctly different species.
13. Explain how the theory of natural selection accounts for an increase in the proportion of individuals with advantageous characteristics within a species.

STANDARD 5.8	ALL STUDENTS WILL GAIN AN UNDERSTANDING OF THE STRUCTURE AND BEHAVIOR OF MATTER.
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Descriptive Statement: Exploring the nature of matter and energy is essential to an understanding of the physical universe. This standard leads students from their experiences with the states and properties of matter, to the development of models of the atom and the underlying principles of chemistry.

Cumulative Progress Indicators

By the end of **Grade 4**, students:

1. Describe and sort objects according to the materials from which they are made and their physical properties.
2. Recognize that matter can exist as a solid, liquid, or gas, and can be transformed from one state to another by heating or cooling.
3. Investigate matter by observing materials under magnification.

Building upon knowledge and skills gained in the preceding grades, by the end of **Grade 8**, students:

4. Identify characteristic properties of matter, and use one or more of those properties to separate a mixture of substances.
5. Show how substances can react with each other to form new substances having characteristic properties different from those of the original substances.
6. Know that all matter is made up of atoms that may join together to form molecules, and that the state of matter is determined by the arrangement and motion of the atoms or molecules.
7. Explain how atoms are rearranged when substances react, but that the total number of atoms and the total mass of the newly formed substances remains the same as that of the original substances.
8. Explain that over 100 different atoms, corresponding to over 100 different elements, have been identified and can be grouped according to their similar properties.

Building upon knowledge and skills gained in the preceding grades, by the end of **Grade 12**, students:

9. Know that atoms consist of a nucleus surrounded by electrons, and that the arrangement of the electrons determines the chemical behavior of each element.
10. Know that the nucleus consists of protons and neutrons, and that each atom of a given element has the same number of protons, but that the number of neutrons may vary.
11. Explain how atoms can form bonds to other atoms by transferring or sharing electrons.
12. Demonstrate different types of chemical reactions and the various factors affecting reaction rates.
13. Explain how the Periodic Table of Elements evolved and how it relates atomic structure to the physical and chemical properties of the elements.

STANDARD 5.9	ALL STUDENTS WILL GAIN AN UNDERSTANDING OF NATURAL LAWS AS THEY APPLY TO MOTION, FORCES, AND ENERGY TRANSFORMATIONS.
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Descriptive Statement: Basic principles of physics emerge in this standard, where the study of force and motion leads students to the concept of energy. All forms of energy are introduced and investigated, and principles of transformation and laws of conservation are developed.

Cumulative Progress Indicators

By the end of **Grade 4**, students:

1. Demonstrate that the motion of an object can vary in speed and direction.
2. Demonstrate that the position and motion of an object can be changed by pushing or pulling and that the change is related to the strength of the push or pull.
3. Recognize that some forces are invisible and can act at a distance.
4. Investigate sources of heat and show how heat can be transferred from one place to another.
5. Investigate sources of light and show how light behaves when it strikes different objects.
6. Demonstrate how sound can be produced by vibrating objects and how the pitch of the sound depends on the rate of vibration.
7. Demonstrate how electricity can be used to produce heat, light, and sound.

Building upon knowledge and skills gained in the preceding grades, by the end of **Grade 8**, students:

8. Explain how a moving object that is not being subjected to a net force will move in a straight line at a steady speed.
9. Show that when more than one force acts on an object at the same time, the forces can reinforce or cancel each other, producing a net force that will change the speed or direction of the object.
10. Investigate how the force of friction acts to retard motion.
11. Describe the various forms of energy, including heat, light, sound, chemical, nuclear, mechanical, and electrical energy, and that energy can be transformed from one form to another.
12. Explain how heat flows through materials or across space from warmer objects to cooler ones until both objects are at the same temperature.

13. Explain that the sun is a major source of the earth's energy and that energy is emitted in various forms, including visible light, infrared and ultraviolet radiation.
14. Show how light is reflected, refracted, or absorbed when it interacts with matter and how colors appear as a result of this interaction.
15. Show how vibrations in materials can generate waves which can transfer energy from one place to another.

Building upon knowledge and skills gained in the preceding grades, by the end of **Grade 12**, students:

16. Explain the mathematical relationship between the mass of an object, the unbalanced force exerted on it, and the resulting acceleration.
17. Prove that whenever one object exerts a force on another, an equal amount of force is exerted back on the first object.
18. Know that gravity is a universal force of attraction between masses that depends on the masses and the distance between them.
19. Know that electrically charged bodies can attract or repel each other with a force that depends on the size and nature of the charges and the distance between them.
20. Explain the similarities and differences between gravitational forces and electrical forces that act at a distance.
21. Know that the forces that hold the nucleus of an atom together are stronger than electromagnetic forces and that significant amounts of energy are released during nuclear changes.
22. Explain how electromagnetic waves are generated, and identify the components of the electromagnetic spectrum.
23. Explain that all energy is either kinetic or potential and that the total energy of the universe is constant.

STANDARD 5.10	ALL STUDENTS WILL GAIN AN UNDERSTANDING OF THE STRUCTURE, DYNAMICS, AND GEOPHYSICAL SYSTEMS OF THE EARTH.
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Descriptive Statement: The study of science should include a study of the planet Earth and its relationship to the rest of the universe. This standard describes what students should know about the composition of the earth and the forces that shape it, while Standard 5.11 describes what students should know about astronomy and space science.

Cumulative Progress Indicators

By the end of **Grade 4**, students:

1. Recognize and demonstrate the use of different kinds of maps.
2. Investigate materials that make up the earth, including rocks, minerals, soils, and fossils, and how they are formed.
3. Identify major sources and uses of water, discussing the forms in which it appears.
4. Collect and record weather data to identify existing weather conditions, and recognize how those conditions affect our daily lives.

Building upon knowledge and skills gained in the preceding grades, by the end of **Grade 8**, students:

5. Compare different map projections, and explain how physical features are represented on each.
6. Identify the major features of the earth's crust, the processes and events that change them, and the impact of those changes on people.
7. Identify the age of fossils, and explain how they provide evidence that life has changed through time.
8. Describe and explain the causes of the natural processes and events that shaped the earth's surface and interior.
9. Monitor local weather conditions and changes in the atmosphere that lead to weather systems.
10. Investigate the composition, cycling, and distribution of the world's oceans and other naturally occurring sources of water.

Building upon knowledge and skills gained in the preceding grades, by the end of **Grade 12**, students:

11. Use the evidence provided by topography, fossils, rock stratification, ice cores, and radiometric data to investigate the earth's changes.
12. Use the theory of plate tectonics to explain the relationship among earthquakes, volcanoes, mid-ocean ridges, and deep sea trenches.
13. Explore how weather phenomena and human activity are interrelated.
14. Identify and explain factors that influence water quality needed to sustain life.

STANDARD 5.11	ALL STUDENTS WILL GAIN AN UNDERSTANDING OF THE ORIGIN, EVOLUTION, AND STRUCTURE OF THE UNIVERSE.
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Descriptive Statement: The study of science should include a study of the planet earth and its relationship to the rest of the universe. This standard describes what students should know about astronomy and space science, while Standard 5.10 describes what students should know about the composition of the earth and the forces that shape it.

Cumulative Progress Indicators

By the end of **Grade 4**, students:

1. Observe and identify objects and their apparent motion in the day and night sky.
2. Relate the motions of the earth-sun-moon system to units of time (days, months, seasons, years).
3. Construct a model of the solar system.

Building upon knowledge and skills gained in the preceding grades, by the end of **Grade 8**, students:

4. Describe the physical characteristics of the components of the solar system, and compare the earth to other planets.
5. Explain how naturally occurring events on earth are related to the positions of the sun, earth, and moon.
6. Describe the technologies used to explore the universe.

Building upon knowledge and skills gained in the preceding grades, by the end of **Grade 12**, students:

7. Construct a model that accounts for variation in the length of day and night.
8. Evaluate evidence that supports scientific theories of the origin of the universe.
9. Analyze benefits generated by the technology of space exploration.

STANDARD 5.12	ALL STUDENTS WILL DEVELOP AN UNDERSTANDING OF THE ENVIRONMENT AS A SYSTEM OF INTERDEPENDENT COMPONENTS AFFECTED BY HUMAN ACTIVITY AND NATURAL PHENOMENA.
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Descriptive Statement: Creating an awareness of the need to protect and preserve natural resources is a goal of science education. This standard calls for students to develop knowledge of environmental issues, including management of natural resources, production and use of energy, waste management, and the interdependence of ecosystems.

Cumulative Progress Indicators

By the end of **Grade 4**, students:

1. Investigate the interdependence of living things and their environment.
2. Explain how meeting human requirements affects the environment.
3. Recognize that natural resources are not always renewable.

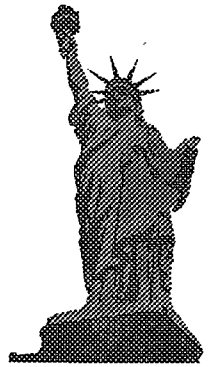
Building upon knowledge and skills gained in the preceding grades, by the end of **Grade 8**, students:

4. Evaluate the impact of personal and societal activities on the local and global environment.
5. Compare and contrast practices that affect the use and management of natural resources.
6. Recognize that individuals and groups may have differing points of view on environmental issues.
7. Analyze the components of various ecosystems and the effects of those components on organisms.

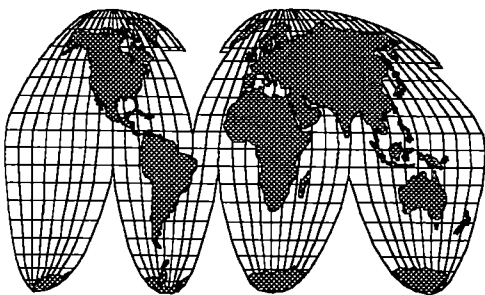
Building upon knowledge and skills gained in the preceding grades, by the end of **Grade 12**, students:

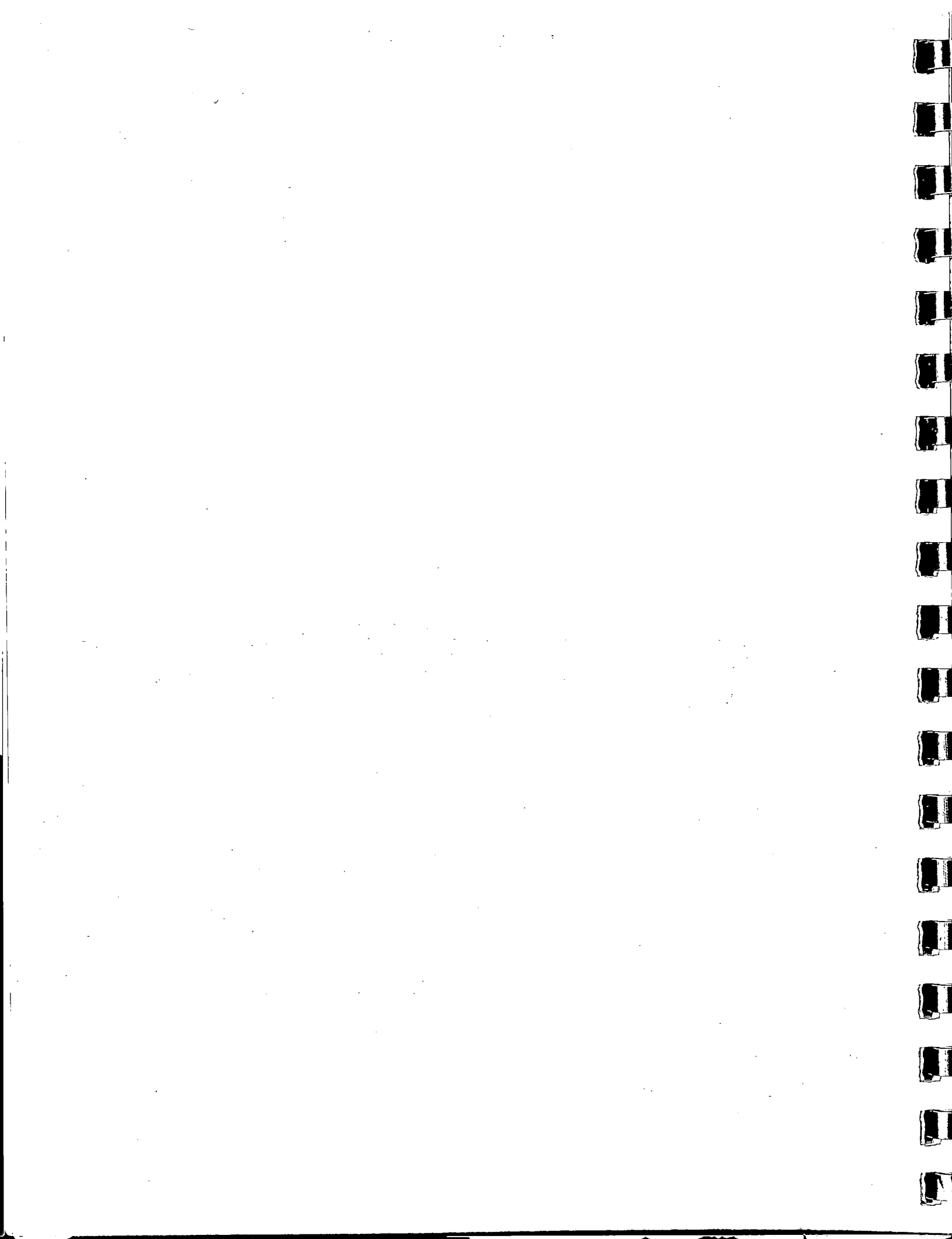
8. Investigate the impact of natural phenomena and physical processes, such as earthquakes, volcanoes, forest fires, floods, and hurricanes, on the environment of different regions of the United States and the world.
9. Use scientific, economic, and other data to assess environmental risks and benefits associated with human activity.
10. Apply the concept of ecosystems to understand and solve problems regarding environmental issues.





SOCIAL STUDIES





New Jersey Core Curriculum Content Standards for Social Studies

Introduction

Citizen participation in government is essential in forming this nation's democracy, and is vital in sustaining it. Social studies education promotes loyalty and love of country and it prepares students to participate intelligently in public affairs. Its component disciplines foster in students the knowledge and skills needed to make sense of current political and social issues. By studying history, geography, American government and politics and other nations, students can learn to contribute to national, state and local decision-making. They will also develop an understanding of the American constitutional system, an active awareness and commitment to the rights and responsibilities of citizenship, a tolerance for those with whom they disagree, and an understanding of the world beyond the borders of the United States.

The Supreme Court of New Jersey underscored the role of the social studies in fulfilling the state's obligation to offer all children a "thorough and efficient education" with these words:

Thorough and efficient (education) means being able to fulfill one's role as a citizen, a role that encompasses far more than merely registering to vote. It means the ability to participate fully in society, in the life of one's community, the ability to appreciate music, art, and literature, and the ability to share all that with friends.

-Abbott v. Burke 119 NJ 287, pp. 363-364 (1990)

The court's thinking reinforces the definition of the National Council for the Social Studies: "Social studies are the integrated study of social sciences and humanities to promote civic competence." (NCSS Curriculum Standards for Social Studies, 1994). The New Jersey core curriculum content standards for Social Studies focus on defining the knowledge and skills students need to "make informed and reasoned choices for the public good as citizens of a culturally diverse, democratic society in an interdependent world." (NCSS, 1994) The social studies curriculum must work to reinforce our nation's most important ideals, including the dignity and equality of all individuals and the notion of the common good. "Some values are so central to our way of life and our view of the common good that we need to develop students' commitment to them through systematic social studies experiences....These include rights, freedoms and responsibilities of the individual, and beliefs concerning social conditions and

government responsibilities." (NCSS, 1994) And, at a fundamental level, the Social Studies curriculum fosters the bedrock value of patriotism and the overarching quest to nurture a good person.

The New Jersey core curriculum content standards for Social Studies are designed to prepare students for their future role as intelligent and active citizens in our democratic society. Three areas of humanities study - history, citizenship and geography - are emphasized to provide students with understanding of human interaction through time. Embedded in these content areas are economic, cultural, anthropological, sociological and global perspectives. By studying the human condition in these contexts, students will gain an understanding of their own country's history, institutions and environment, and also of the forces that have shaped world cultures. Moreover, students will learn to view contemporary problems facing the nation and the world as products of complex historical, institutional, and environmental processes, rather than as isolated events which lack deep meaning. These standards offer students a set of shared understandings about our nation and the world which are the basis for intelligent discussion about how to achieve democratic goals of justice, equality, and social progress.

In order to ensure that students share a common core of knowledge, by the end of their school experience students of United States history should have studied all five of the following major periods in history:

- The Colonial Period (to 1763)
- The Revolution and Early National Period (to 1820)
- The Age of Civil War and Reconstruction (to 1870)
- Industrial America and the Era of World Wars (to 1945)
- The Modern Age

In addition, students of World History should have studied all seven of the following World History periods:

- Prehistory (to 2000 BC)
- The Ancient World (to 500 BC)
- The World of Hemispheric Interactions and the "Middle Ages" (to 1400)
- The Age of Global Encounters (to 1700)
- The Age of Revolutions (to 1850)
- The Age of Imperialism and World War (to 1950)
- The Modern World

School districts are encouraged to define the balance among materials from Western, Asian, African, and other world cultures in each of these periods. Furthermore, several suggested themes are included among the history standards (6.3 through 6.6) to enhance and enrich the study of history.

The social studies standards are grouped for study and inquiry in the following manner:

Standards 6.1 and 6.2: educating students for democratic citizenship.

Standards 6.3 through 6.6: educating students for historical understanding.

Standards 6.7 through 6.9: educating students for geographical understanding.

In developing these standards, the Social Studies Standards Committee reflected the obligation of New Jersey's schools to the State and its Constitution, to the State's citizenry, to the children whose habits of thought and problem-solving skills are in the school's trust, and to the institutions of higher education which receive New Jersey's high school graduates. These content standards for Social Studies outline the academic paths through which students can explore the diversity and commonalities of human experience.

SOCIAL STUDIES LIST OF STANDARDS

- 6.1 All students will learn democratic citizenship and how to participate in the constitutional system of government of the United States.
- 6.2 All students will learn democratic citizenship through the humanities, by studying literature, art, history and philosophy, and related fields.
- 6.3 All students will acquire historical understanding of political and diplomatic ideas, forces, and institutions throughout the history of New Jersey, the United States, and the world.
- 6.4 All students will acquire historical understanding of societal ideas and forces throughout the history of New Jersey, the United States, and the world.
- 6.5 All students will acquire historical understanding of varying cultures throughout the history of New Jersey, the United States, and the world.
- 6.6 All students will acquire historical understanding of economic forces, ideas, and institutions throughout the history of New Jersey, the United States, and the world.
- 6.7 All students will acquire geographical understanding by studying the world in spatial terms.
- 6.8 All students will acquire geographical understanding by studying human systems in geography.
- 6.9 All students will acquire geographical understanding by studying the environment and society.

**SOCIAL STUDIES
STANDARDS AND PERFORMANCE INDICATORS**

STANDARD 6.1 ALL STUDENTS WILL LEARN DEMOCRATIC CITIZENSHIP AND HOW TO PARTICIPATE IN THE CONSTITUTIONAL SYSTEM OF GOVERNMENT OF THE UNITED STATES.
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Descriptive Statement: Social studies must promote civic and democratic principles so that students become informed and active citizens. Before students can make informed decisions, they must have a knowledge of the United States Constitution and the constitutional system of the United States Government. Students should participate actively in constructive public action, including registering to vote, and should seek ways to contribute based on the rights and privileges afforded all citizens.

Cumulative Progress Indicators

By the end of **Grade 4**, students:

1. Identify key principles embodied in the United States Constitution, and discuss their application in specific situations.
2. Identify examples of the rights and responsibilities of citizens.
3. Assess information about a public issue.
4. Give examples of the impact of government policy on their lives.
5. Identify key documents which represent democratic principles and beliefs, such as the Declaration of Independence, the United States Constitution, the Bill of Rights, the New Jersey Constitution, and the Pledge of Allegiance.
6. Identify symbols of American principles and beliefs, such as the flag and the blindfolded Statue of Justice.

Building upon knowledge and skills gained in the preceding grades, by the end of **Grade 8**, students:

5. Examine the origins and continuing application of key principles embodied in the United States Constitution.
6. Identify and interpret the balance between the rights and the responsibilities of citizens.
7. Locate, access, analyze, organize, and apply information about public issues, recognizing and explaining multiple points of view.
8. Analyze the functions of the executive, judicial, and legislative branches of government.
9. Apply knowledge of governmental structure and process to school, town, and community life.

Building upon knowledge and skills gained in the preceding grades, by the end of **Grade 12**, students:

10. Explain the origins and interpret the continuing influence of key principles embodied in the United States Constitution.
11. Analyze the balance between the rights and responsibilities of citizens, and apply the analysis to understanding issues facing society in New Jersey and the United States.
12. Locate, access, analyze, organize, and apply information about public issues in order to evaluate the validity of different points of view.
13. Analyze the roles of the individual and the government in promoting the general welfare of the community under our Constitution.
14. Analyze the functioning of government processes, such as elections, in school, town, or community projects.

STANDARD 6.2	ALL STUDENTS WILL LEARN DEMOCRATIC CITIZENSHIP THROUGH THE HUMANITIES, BY STUDYING LITERATURE, ART, HISTORY AND PHILOSOPHY, AND RELATED FIELDS.
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Descriptive Statement: The humanities, history, literature, the arts, philosophy, law and related fields of study, enrich students' understanding of the human experience. They form a body of knowledge about human experience that is indispensable to informed civic participation in our democratic society. They enable students to recognize the moral and ethical dilemmas which have brought us to the present, and to project where our choices may lead in the future.

Through reading, writing, viewing and discussing humanities materials, students develop a knowledge base for understanding the complexities of American and world cultures. The humanities also equip students with a set of conceptual tools needed to engage in informed civic discourse about how to resolve conflicts between diverse cultures within our democratic society.

Cumulative Progress Indicators

By the end of **Grade 4**, students:

1. Recognize human experiences through time, as depicted in works of history, and literature and in the fine arts.
2. Identify social history represented in works of literature and the fine arts.
3. Understand how works of aesthetic expression serve as cultural representations.
4. Evaluate works, such as personal creations, which communicate a human condition or question.

Building upon knowledge and skills gained in the preceding grades, by the end of **Grade 8**, students:

5. Compare and contrast examples of artistic and literary expression from different historical and social settings.
6. Analyze examples of art, literature, philosophy, and architecture that have influenced, and been influenced by, their societies and cultures.
7. Analyze and explain different artistic, literary and historical depictions of the same subject.
8. Identify the mutual impact of technology and aesthetic expression.

Building upon knowledge and skills gained in the preceding grades, by the end of **Grade 12**, students:

9. Give examples of historical, literary, and artistic works which have influenced society in the past and present, and identify their effect on our understanding of basic human rights.
10. Examine the relationship between the beliefs and life circumstances of a writer, artist, and philosopher, and that person's creative work.
11. Compare artistic and literary interpretations of historical events with accounts of the same events that aim at objectivity.

STANDARD 6.3	ALL STUDENTS WILL ACQUIRE HISTORICAL UNDERSTANDING OF POLITICAL AND DIPLOMATIC IDEAS, FORCES, AND INSTITUTIONS THROUGHOUT THE HISTORY OF NEW JERSEY, THE UNITED STATES, AND THE WORLD.
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Descriptive Statement: History is the study of the human past: society's memory of where it has been, what it values, and how decisions of the past have contributed to present conditions. History deals with chronological sequences, continuity and change, the multiple causes and effects of historical phenomena, and changing interpretations of the past. Historical inquiry enables students to evaluate evidence and analyze events, fostering informed decision-making and thoughtful reflection.

In order to ensure that students share a common core of knowledge, by the end of their school experience students of United States history should have studied all five of the following major periods in history:

- The Colonial Period (to 1763)
- The Revolution and Early National Period (to 1820)
- The Age of Civil War and Reconstruction (to 1870)
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In addition, students of World History should have studied all seven of the following World History Periods:

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- The Age of Global Encounters (to 1700)
- The Age of Revolutions (to 1850)
- The Age of Imperialism and World War (to 1950)
- The Modern World

School districts are encouraged to define the balance among materials from Western, Asian, African, and other world cultures materials in each of these periods. Furthermore, several suggested themes are included among the history standards to enhance and enrich the study of history.

Cumulative Progress Indicators

By the end of **Grade 4**, students:

1. Apply the concepts of cause, effect, and consequences to historical events.
2. Analyze varying viewpoints of individuals and groups at turning points throughout history.
3. Identify and explain how events and changes occurred in significant historical periods.
4. Explain issues, standards, and conflicts related to universal human rights.

Building upon knowledge and skills gained in the preceding grades, by the end of **Grade 8**, students:

5. Explain relationships between cause, effect, and consequences, in order to understand significant historical events.
6. Assess positions of proponents and opponents at turning points throughout history.
7. Analyze how events and changes occurred in significant historical periods.
8. Understand issues, standards, and conflicts related to universal human rights.

Building upon knowledge and skills gained in the preceding grades, by the end of **Grade 12**, students:

9. Understand the complexity of historical causation.
10. Analyze how and why different historians may weigh causal factors differently, and why historical interpretations change over time.
11. Compare and contrast divergent interpretations of historical turning points, using available evidence.
12. Understand the views of people of other times and places regarding the issues they have faced.
13. Synthesize historical facts and interpretations to reach personal conclusions about significant historical events.
14. Analyze and formulate policy statements demonstrating an understanding of issues, standards, and conflicts related to universal human rights.

Themes

By the end of their school years, students should have studied, within the periods outlined above, a designated number of the following specific themes:

The history of different political systems, with special attention to democracy; the history of relations among different political groups and entities; the history of warfare; the history of political leadership.

STANDARD 6.4	ALL STUDENTS WILL ACQUIRE HISTORICAL UNDERSTANDING OF SOCIETAL IDEAS AND FORCES THROUGHOUT THE HISTORY OF NEW JERSEY, THE UNITED STATES, AND THE WORLD.
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Descriptive Statement: The present can only be understood in the context of understanding how and why people acted in the past. History studies human behavior and motivation, since people have created governments and institutions based on their needs. Students should have opportunities to study the impact of various societal forces on the history of New Jersey, the United States, and the world.

In order to ensure that students share a common core of knowledge, by the end of their school experience students should have studied all five of the major periods in United States history cited in Social Studies Standard 6.3. In addition, students should have studied all seven of the World History periods cited in Social Studies Standard 6.3. School districts are encouraged to define the balance among materials from Western, Asian, African, and other world cultures in each of these periods. Furthermore, several suggested themes are included among the history standards to enhance and enrich the study of history.

Cumulative Progress Indicators

By the end of **Grade 4**, students:

1. Compare and contrast similarities and differences in daily life over time.
2. Identify social institutions, such as family, religion, and government, that function to meet individual and group needs.
3. Identify instances when the needs of an individual or group are not met by their social institutions.
4. Identify events when people have engaged in cruel and inhumane behavior.

Building upon knowledge and skills gained in the preceding grades, by the end of **Grade 8**, students:

5. Compare and contrast developments in societies separated by time and/or distance.
6. Compare and contrast fixed customs of societies in the past and the present, and explain how these customs represent the society's beliefs.
7. Understand how family, community, and social institutions function to meet individual and group needs.
8. Understand how historical and contemporary ideas, perceptions, and occurrences have led to prejudice, discrimination, expulsion, genocide, slavery, and the Holocaust.

Building upon knowledge and skills gained in the preceding grades, by the end of **Grade 12**, students:

9. Evaluate the views, beliefs, and impact of different social groups on a given historical event or issue.
10. Evaluate how individuals, groups, and institutions influence solutions to society's problems.
11. Analyze historical and contemporary circumstances in which institutions function either to maintain continuity or to promote change.
12. Argue an ethical position regarding a dilemma from the study of key turning points in history.
13. Evaluate actions an individual, group, or institution might take to counteract incidents of prejudice, discrimination, expulsion, genocide, slavery, and the Holocaust.

Themes

By the end of their school years, students should have studied, within the periods outlined above, a designated number of the following specific themes:

The history of social classes and relations; the history of gender differentiation; the history of slavery; the history of agriculture; the history of population movements; the history of cities and city life.

STANDARD 6.5	ALL STUDENTS WILL ACQUIRE HISTORICAL UNDERSTANDING OF VARYING CULTURES THROUGHOUT THE HISTORY OF NEW JERSEY, THE UNITED STATES, AND THE WORLD.
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Descriptive Statement: Because we live in an interdependent world, students should be aware of the variety of approaches used by different cultures to define and meet their basic needs. Students should understand the impact of different cultures and civilizations at specific times and over time, and be aware of cultural similarities as well as differences. As students become more aware of varying cultures, they are more likely to understand themselves, the diversity and cultural values of others, and people in their own communities and in other parts of the world.

In order to ensure that students share a common core of knowledge, by the end of their school experience students should have studied all five of the major periods in United States history cited in Social Studies Standard 6.3. In addition, students should have studied all seven of the World History periods cited in Social Studies Standard 6.3. School districts are encouraged to define the balance among materials from Western, Asian, African, and other world cultures in each of these periods. Furthermore, several suggested themes are included among the history standards to enhance and enrich the study of history.

Cumulative Progress Indicators

By the end of **Grade 4**, students:

1. Identify common elements found in different cultures.
2. Describe ways that family members, teachers, and community groups influence students' daily lives.
3. Describe the customs of people from different geographic, cultural, racial, religious, and ethnic backgrounds.
4. Describe the influence of technology in daily life.
5. Understand material artifacts of a culture.
6. Examine particular events, and identify reasons why individuals from different cultures might respond to them in different ways.

Building upon knowledge and skills gained in the preceding grades, by the end of **Grade 8**, students:

7. Analyze differences and similarities among cultures.
8. Analyze the influence of various cultural institutions, such as family, religion, education, economic and political systems, on individual decision-making.
9. Understand the customs of people from different geographic, cultural, racial, religious, and ethnic backgrounds.
10. Analyze the political, social, economic, and technological factors which cause cultural change.

11. Analyze how different cultures deal with conflict.
12. Analyze how customs are transmitted in cultures .

Building upon knowledge and skills gained in the preceding grades, by the end of **Grade 12**, students:

13. Analyze the mutual influences among different cultures throughout time.
14. Understand views held by people in other times and places regarding issues they have faced.
15. Interpret how various cultures have adapted to their environments.
16. Analyze how beliefs and principles are transmitted in a culture.
17. Understand the multiple influences of gender, family background, religion, ethnicity, socioeconomic position, and nationality as the bases for analysis of individual identity.
18. Evaluate the mutual influence of technology and culture.

Themes

By the end of their school years, students should have studied, within the periods outlined above, a designated number of the following specific themes:

The history of religion; the history of literature; the history of the arts; the history of education; the history of law; the history of popular culture; the history of philosophy and political and social thought.

STANDARD 6.6	ALL STUDENTS WILL ACQUIRE HISTORICAL UNDERSTANDING OF ECONOMIC FORCES, IDEAS, AND INSTITUTIONS THROUGHOUT THE HISTORY OF NEW JERSEY, THE UNITED STATES, AND THE WORLD.
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Descriptive Statement: Economic systems develop as individuals and societies employ resources to produce and distribute goods and services, while government policies develop to aid, control, and improve these activities. Whether economic decisions and policies are personal, institutional, or governmental, they are made in an interconnected context. Students should have the knowledge and skills to understand the economic forces which influence their lives, and to make decisions which maximize their own economic well-being and that of the larger society.

In order to ensure that students share a common core of knowledge, by the end of their school experience students should have studied all five of the major periods in United States history cited in Social Studies Standard 6.3. In addition, students should have studied all seven of the World History periods cited in Social Studies Standard 6.3. School districts are encouraged to define the balance among materials from Western, Asian, African, and other world cultures in each of these periods. Furthermore, several suggested themes are included among the history standards to enhance and enrich the study of history.

Cumulative Progress Indicators

By the end of **Grade 4**, students:

1. Explain and demonstrate the role of money in everyday life.
2. Describe the relationship of price to supply and demand.
3. Describe work that people perform in our economic system.
4. Distinguish between wants and needs.
5. Illustrate the balance between economic growth and environmental preservation.

Building upon knowledge and skills gained in the preceding grades, by the end of **Grade 8**, students:

6. Identify and differentiate among various forms of exchange.
7. Explain the roles of markets and government policy in meeting the needs and wants of individuals and society.
8. Describe the interaction of various institutions that comprise economic systems, such as households, businesses, banks, government agencies, labor unions, and corporations.
9. Explain and illustrate how attitudes and beliefs influence economic decisions.
10. Evaluate a decision about the balance between economic growth and environmental preservation.

Building upon knowledge and skills gained in the preceding grades, by the end of **Grade 12**, students:

11. Apply economic concepts and reasoning when evaluating historical and contemporary developments and issues.
12. Evaluate principles and policies associated with international trade.
13. Evaluate how the economic system meets wants and needs.
14. Analyze the successes and failures of various economic systems in meeting the needs and wants of their people.
15. Evaluate an economic decision.
16. Analyze and evaluate economic growth in the context of environmental conditions and sustainable development.

Themes

By the end of their school years, students should have studied, within the periods outlined above, a designated number of the following specific themes:

Early agriculture; the history of travel and communications; the role of cities; the history of economic regulation; industrial revolutions; the history of banking and international finance; the history of the corporation.

STANDARD 6.7	ALL STUDENTS WILL ACQUIRE GEOGRAPHICAL UNDERSTANDING BY STUDYING THE WORLD IN SPATIAL TERMS.
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Descriptive Statement: Thinking in spatial terms is essential to knowing and applying geography. It enables students to take an active, questioning approach to the world around them and to ask what, where, when, and why questions about people, places and environments and to formulate answers to critical questions about past, present, and future patterns of spatial organization, and to anticipate the results of events in different locations. Thinking spatially, students learn to devise their own mental maps, which relationships and students' perceptions and attitudes about the area. Thinking spatially enables students to predict what might happen given specific conditions. Spatial concepts and generalizations are powerful tools for explaining the world at all levels, from local to global. They are the foundation for geographical understanding.

Cumulative Progress Indicators

By the end of **Grade 4**, students:

1. Use maps, globes, graphs, diagrams, and computer-based references and information systems to generate and interpret information.
2. Use mental maps to identify the locations of places within the local community and in nearby communities.
3. Use mental maps to identify the locations of the earth's continents and oceans in relation to each other and in relation to principal parallels and meridians.
4. Use mental maps to identify the locations of major physical and human characteristics in the United States and on earth.
5. Demonstrate understanding of the spatial concepts of location, distance, direction, scale, region, and movement.

Building upon knowledge and skills gained in the preceding grades, by the end of **Grade 8**, students:

6. Recognize the distinct characteristics of maps, globes, graphs, charts, diagrams, and other geographical representations, and evaluate the utility of each in solving geographical problems.
7. Translate maps into appropriate graphics to display geographical information.
8. Answer geographical questions regarding major physical and human characteristics.
9. Solve location problems using information from multiple sources.
10. Compare information presented at different scales.

Building upon knowledge and skills gained in the preceding grades, by the end of **Grade 12**, students:

11. Use and interpret maps and other graphical representations to analyze, explain, and solve geographical problems.
12. Use maps of physical and human characteristics of the world to answer complex geographical questions.

STANDARD 6.8**ALL STUDENTS WILL ACQUIRE GEOGRAPHICAL UNDERSTANDING BY STUDYING HUMAN SYSTEMS IN GEOGRAPHY.**

Descriptive Statement: Students need to understand the interaction of human and environmental factors. The study of human systems includes the characteristics, distribution, and migration of human populations on the earth's surface; the characteristics, distribution and complexity of the earth's cultures; patterns and networks of economic interdependence; processes, patterns, and functions of human settlement; and how cooperation and conflict influence the division and control of the earth's surface.

Cumulative Progress Indicators

By the end of **Grade 4**, students:

1. Identify the distribution and characteristics of populations at different scales, and understand the causes and effects of human migration.
2. Discuss the similarities, differences, and interdependencies among rural, suburban, and urban communities.
3. Compare the effects of geography on economic activities locally and in New Jersey, the United States, and different parts of the world.
4. Explain how improvements in transportation and communication have resulted in global interdependence.
5. Compare the physical characteristics of places and regions.

Building upon knowledge and skills gained in the preceding grades, by the end of **Grade 8**, students:

6. Compare and analyze demographic characteristics of populations, and determine the reasons for variations.
7. Identify the spatial patterns of settlement in different regions of the world.
8. Explain the causes and effects of urbanization.
9. Give reasons for the changes in spatial patterns of human activities.
10. Describe how changes in technology affect the location of human activities.
11. Give reasons for global interdependence.

Building upon knowledge and skills gained in the preceding grades, by the end of **Grade 12**, students:

12. Predict trends in world population numbers and patterns.
13. Analyze the impact of human migration on physical and human systems.

14. Analyze and compare the functions and spatial arrangement of cities locally and globally.
15. Analyze the processes that change urban structure, and the impact of changes in urban areas.
16. Explain the historical movement pattern of people and goods, and analyze the bases for increasing global interdependence.
17. Explain how physical, social, cultural, and economic processes shape the features of places and regions.

STANDARD 6.9	ALL STUDENTS WILL ACQUIRE GEOGRAPHICAL UNDERSTANDING BY STUDYING THE ENVIRONMENT AND SOCIETY.
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Descriptive Statement: Students should learn how people are able to live in various kinds of physical environments by developing patterns of spatial organization that take advantage of opportunities and avoid or minimize limitations.

Cumulative Progress Indicators

By the end of **Grade 4**, students:

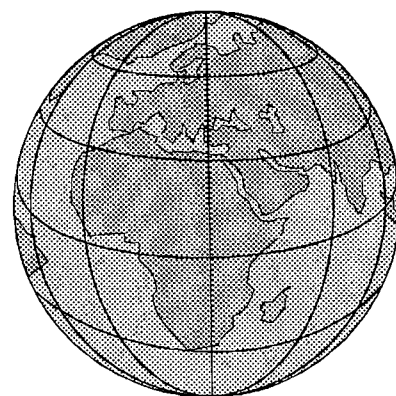
1. Explain the characteristics of renewable and nonrenewable resources and their distribution, and the role of resources in daily life.
2. Explain how people depend on the physical environment and how they modify the environment.
3. Identify the consequences of natural environmental changes and crises and human modifications of the environment, and explain how an event in one location can have an impact upon another location.

Building upon knowledge and skills gained in the preceding grades, by the end of **Grade 8**, students:

4. Describe world patterns of resource distribution and utilization, and discuss the management and use of renewable and nonrenewable resources.
5. Explain and predict how the physical environment can accommodate, and be affected by human activity.

Building upon knowledge and skills gained in the preceding grades, by the end of **Grade 12**, students:

6. Evaluate policies and programs related to the use of resources locally and globally.
7. Draw conclusions regarding the global impact of human modification of the environment.
8. Evaluate the environmental consequences of technological change in human history.



WORLD LANGUAGES



New Jersey Core Curriculum Content Standards for World Languages

Introduction

New Jersey is home to more than 100 ethnic groups, and about 125 different languages are spoken in our state. To support the growth of New Jersey's dynamic economy as we move into the twenty-first century, our state needs educated citizens whose multilingual abilities and multicultural sensitivities prepare them to work in a pluralistic society and a global economy. As countries become increasingly interdependent, it is essential that we actively promote proficiency in world languages to improve cross-cultural understanding. We must therefore help New Jersey students to broaden their personal and professional opportunities by giving them the ability to communicate in other languages, and the understanding needed to function in different cultural contexts. As a branch of the humanities, language education facilitates cross-cultural understanding by providing students with the tools to decode the histories and cultural practices embedded in world languages.

We refer to the languages we teach as **World Languages** to reflect the experience of the cultures that preceded us and our own multilanguage population. This section is titled **World Languages** in support of all the languages and peoples of the world, and in acknowledgment of our responsibility to communicate with others. The core curriculum content standards for **World Languages** are guided by the following principles:

World languages are an essential part of the education of all students. Elementary and high school students who have had the opportunity to study a world language benefit in the following ways:

Greater academic achievement in other areas of study, including reading, social studies, and mathematics.

Higher scores on Scholastic Achievement Tests (SAT), American College Tests (ACT), and other standardized tests, regardless of their ability level or socioeconomic status.

Improved understanding of the English language and greater sensitivity to structure, vocabulary, and syntax.

Improved reasoning, conceptualizing, and analyzing, along with better listening and memory skills.

Enhanced employment opportunities and work relationships.

Personal satisfaction through the ability to communicate across languages and cultures.

The primary goal of a world language program is effective communication. The experience of communicating in other languages makes this discipline unique. Students will be able to use the languages they have studied in meaningful ways because they experience the language in authentic situations. The focus is upon what students can do with the language rather than what they know about it.

Effective communication is a dynamic rather than a static concept. It depends on the interaction and negotiation of meaning between two or more persons who share to some degree the same symbolic systems of written and spoken language. Effective communication takes place in a variety of situations, and success depends on the student's understanding of context, building on prior experience of a similar kind. Teaching thus should be geared toward conversation and understanding, and include the use of non-print (video, audiotapes) as well as print materials.

All students should be able to communicate in at least one language in addition to English. The process of learning another language provides an opportunity for all students to think in a different way and to learn to appreciate differences among people. World language teachers can best encourage such respectful attitudes if their students also represent different backgrounds and experiences. By working together, diverse learners realize that they share a need for language as a tool of expression and communication.

Culture is an integral part of world language learning. Since culture is inextricably woven into the language, we cannot separate language from the culture in which it is used; nor can we isolate cultural information as if culture could be reduced to a collection of facts apart from language. Including the cultural component in all skill areas is important. Connecting language and communication skills with culture creates a more powerful learning experience for students.

An effective world language class is student-centered. Students are actively engaged in using the language by interacting with each other and the teacher, and by communicating about things which have meaning to them.

World language programs should start in kindergarten and continue uninterrupted through grade 12. Research over the last 20 years in the United States and abroad underscores the importance of beginning world language study at an early age, when children easily and naturally acquire language. The primary years are the best time to begin second language study. The degree of language proficiency is directly proportional to the amount of time spent by students in meaningful communication in the language studied.

An effective world language program provides content that is meaningful and interesting to students. It provides developmentally and age appropriate activities integrating language components such as understanding, listening, speaking, reading, writing, and culture in order to promote active communication. The success of any world language program depends upon the cooperation of the entire school community: students, teachers, parents, administration, and board of education.

Beginning a world language program in the early primary grades sends a strong message about the value our society places on knowing other languages and cultures. Such a message helps bilingual and limited-English proficient students to appreciate their own heritage, language, and culture, and sets the stage for successful school experience. An early start enables all children to view language learning and insight into other cultures as integral parts of their school experience.

World languages connect with all other disciplines. Successful language learning activities are interdisciplinary. World languages have more meaning and purpose when tasks are a natural outgrowth of school life, and emerge from the content area of other disciplines. A content-enriched approach develops students' skills in the studied language while enhancing their knowledge of the content of other humanities disciplines, such as literature, history, and geography. Connections may flow from other areas to the world language classroom, or may originate in the world language classroom to add unique insight to the rest of the curriculum.

Program Design

Communities should provide a strong, well-articulated sequence of language study. Various program models and staffing options leading to world language proficiency are available to school districts and program planners. Because each school district has its own particular characteristics, a variety of solutions will evolve from the needs of each community. Districts must choose options according to the language proficiency outcomes they desire, and the budgetary and staffing circumstances in which they find themselves. Other considerations might be: the languages that the community and the students prefer, based on local traditions and ethnic interests; the availability of well-trained teachers who might reasonably be expected to stay with the program for a number of years; and the number of languages that the school population can support without eliminating the possibility of offering advanced level courses. In considering the above, the school district should identify the priority of communicative functions or speech acts the students should be able to perform in the second language, and the structures needed for active communication. Compelling rationale can be developed for any world language, and any language, when well taught, can provide students with the benefits of global awareness, enhanced skills in content areas, awareness of other cultures, and increased language skills and self-esteem.

Program Implementation

Expecting elementary and middle level students to communicate in a second language, even at the beginner level, is new for most schools. However, such an expectation is routine for students of

similar ages in other advanced nations and in some states and some New Jersey school districts. Because it is the academic content area with which we have the least experience, New Jersey will assess world languages for the first time in school year 2001-2002. Therefore, schools will have six years to prepare for this content area to "come on line." Districts will have discretion in deciding at what grade (e.g., K,1,2,3,4) and in what year (e.g., 1996/97 - 2001/2002) to introduce world languages into their education program.

The "content standards" are the results expected by the completion of a student's K-12 experience. They are accompanied by progress indicators for the end of grades 4, 8 and 12. These indicators describe what knowledge and skills students are expected to acquire by these benchmark grades. As with all other content standards, world languages will be further defined by companion "performance standards." Performance tasks and levels will be developed through New Jersey's State Assessment Program at grades 4, 8 and 11/12. Performance standards will be developed in consultation with elementary teachers and world language specialists. These standards will be set at realistic levels that emphasize students' general exposure to the language and its culture.

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- President's Commission on Foreign Language & International Studies. (1979). Strength through wisdom.

**WORLD LANGUAGES
LIST OF STANDARDS**

- 7.1 All students will be able to communicate at a basic literacy level in at least one language other than English.
- 7.2 All students will be able to demonstrate an understanding of the interrelationship between language and culture for at least one world language in addition to English.

WORLD LANGUAGES STANDARDS AND PROGRESS INDICATORS

STANDARD 7.1 ALL STUDENTS WILL BE ABLE TO COMMUNICATE AT A BASIC LITERACY LEVEL IN AT LEAST ONE LANGUAGE OTHER THAN ENGLISH.

Descriptive Statement: Meaningful communication is the exchange of thoughts, messages, or information through speech, gestures, behavior, or a combination of these. It is through communication that we express ourselves and transmit or receive information. For these exchanges to be meaningful, students need to communicate about, understand, and interpret written or spoken language on a variety of topics in the language studied. The key to successful communication is knowing how, when, and why to say what to whom. This standard thus focuses on interpersonal communication.

Cumulative Progress Indicators

By the end of **Grade 4**, students:

1. Respond to and initiate simple statements and commands such as greetings, introductions, and leave-taking.
2. Express attitudes, reactions, and courtesy using short phrases and simple sentences.
3. Express likes, dislikes, and preferences.
4. Describe people, places, things, and events using short phrases and simple sentences.
5. Provide and obtain information on familiar topics.
6. Express basic personal needs.
7. Identify some common and distinct features, such as parts of speech and vocabulary, among languages.

Building upon knowledge and skills gained in the preceding grades, by the end of **Grade 8**, students:

8. Create and respond to simple phrases, questions and sentences.
9. Describe people, places, things, and events with some details.
10. Generate and respond to short messages such as invitations, directions, announcements, and appointments.
11. Interact with appropriate responses in limited social settings and basic situations.
12. Express details of their everyday lives and of past experiences.
13. Engage in original and spontaneous conversation in the language studied.
14. Organize thoughts into coherent oral speech.

15. Explore employment opportunities where languages are advantageous.
16. Identify common and distinct features, such as prepositional phrases and clauses, among languages.

Building upon knowledge and skills gained in the preceding grades, by the end of **Grade 12**, students:

17. Communicate and interact in a limited range of task-oriented and social situations.
18. Respond to statements and initiate and sustain conversations with increasing linguistic accuracy.
19. Understand a sustained conversation on a number of topics.
20. Comprehend fluent speakers in everyday situations.
21. Communicate orally with increasing logic and accuracy.
22. Research language-related employment opportunities.
23. Identify common and distinct features, such as grammatical structures, among languages.

STANDARD 7.2 ALL STUDENTS WILL BE ABLE TO DEMONSTRATE AN UNDERSTANDING OF THE INTERRELATIONSHIP BETWEEN LANGUAGE AND CULTURE FOR AT LEAST ONE WORLD LANGUAGE IN ADDITION TO ENGLISH.

Descriptive Statement: The acquisition of another language focuses attention on how language and culture interacts. This interaction helps students reflect on cultural patterns and thus gain insight into their own language and culture. Exploration of a new culture helps students to frame issues about their own world view while investigating another. Comparing and contrasting languages and cultures promotes cross-cultural discourse and understanding which are at the heart of the humanities.

Cumulative Progress Indicators

By the end of **Grade 4**, students:

1. Demonstrate an awareness of culture.
2. Demonstrate knowledge of the cultures of speakers of the language studied.
3. Recognize interrelationships between the language and the culture of a given group of people.
4. Recognize and explore the process of stereotyping.

Building upon knowledge and skills gained in the preceding grades, by the end of **Grade 8**, students:

5. Compare the customs of their own culture and the studied culture.
6. Understand the role of stereotyping in forming and sustaining prejudice.
7. Demonstrate an awareness of contributions made in many fields by men and women of diverse cultures.
8. Examine interrelationships between the language and the culture of a given group of people as evidenced in literary works.

Building upon knowledge and skills gained in the preceding grades, by the end of **Grade 12**, students:

9. Recognize and understand verbal and nonverbal cues within a culture.
10. Explore and discuss similarities and differences among various cultures.
11. Explore and discuss representative works of diverse cultures in many fields of endeavor.
12. Analyze interrelationships between the language and the culture of a given group of people, as evidenced in their literary works and communications, as well as in their political, economic, and religious structures.
13. Use technology to enhance language acquisition and to acquire current cultural information in order to develop more accurate impressions of the culture studied.

“Measuring Up for the 21st Century”



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