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ADMINISTRATIVE LAW DIVISION

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OFFICE OF WEST VIRGINIA SECRETARY OF STATE

NOTICE OF AGENCY ADOPTION OF A PROCEDURAL OR INTERPRETIVE RULE OR A LEGISLATIVE RULE EXEMPT FROM LEGISLATIVE REVIEW

AGENCY: WEST VIRGINIA BOARD OF EDUCATION TITLE NUMBER: 126

CITE AUTHORITY: WV Constitution Article XII, Section 2, & WV Code 18-2-5

RULE TYPE: PROCEDURAL _____ INTERPRETIVE _____

EXEMPT LEGISLATIVE RULE X
CITE STATUTE(s) GRANTING EXEMPTION FROM LEGISLATIVE REVIEW

AMENDMENT TO AN EXISTING RULE: YES X, NO ____

IF YES, SERIES NUMBER OF RULE BEING AMENDED: 44G (Policy 2520.04)

TITLE OF RULE BEING AMENDED: INSTRUCTIONAL GOALS: Science Program of Study

IF NO, SERIES NUMBER OF NEW RULE BEING ADOPTED: _____

TITLE OF RULE BEING ADOPTED: _____

THE ABOVE RULE IS HEREBY ADOPTED AND FILED WITH THE SECRETARY OF STATE. THE EFFECTIVE DATE OF THIS RULE IS December 23, 1992

Barbara L Fox
November 19, 1992

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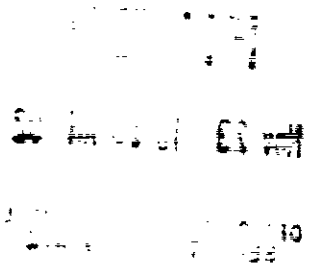

Executive Summary
West Virginia Board of Education

Policy Number and Title: Instructional Goals: Science Program of Study (Policy 2520.04)

Public Comment Period Ends: November 5, 1992 Adopted: 11/13/92

BACKGROUND

The Department of Education systematically reviews and revises programs of study on a six-year cycle prior to adoption of content related instructional materials. The science program of study was last revised in 1985-86. To assure that our students will graduate with the knowledge and skills needed to succeed in a competitive and changing scientific society, and to strengthen the science curriculum for West Virginia students, the Department of Education embarked on the development of the West Virginia Science Curriculum Framework.

To identify the scope and direction of the West Virginia Science Curriculum Framework, a committee of science teachers, scientists, and administrators was convened. The task of the committee was to review the literature on national reform science initiatives, review curriculum frameworks of other states, and review the current West Virginia science program of study. After extensive study of Project 2061 - Science for All Americans (American Association for the Advancement of Science, 1989) and the National Science Teachers Association's Scope, Sequence, and Coordination Project, the West Virginia Science Curriculum Framework Drafting Committee recommended the redesign of the science program of study.

PURPOSE

The purpose of the West Virginia Science Curriculum Framework is to assure students both high quality curriculum and instructional materials to support the delivery of high quality effective instruction. The Science Instructional Goals enunciated in the framework reflect current trends and recent research in science education.

CONTENT

The program of study is redesigned to establish a thematic, coordinated science approach at each grade level for all K-10 students. Optional in-depth studies of the natural sciences and science applications will be provided for students in grades 11 and 12.

Specific features include:

- Thematic organization which allows for student learning in a real world context;
- Developmental coordination to assure an engaging, consistent growth process for all students; and,
- Rigorous science courses for the 11th and 12th grades that promote in-depth learning in content and applications in the high school years.

The instructional goals at each programmatic level address the nature of science, scientific attitudes/habits of mind, scientific processes/thinking skills, laboratory investigations/hands-on learning, science content, science history, and science and technology.

This policy has been out on comment since September 1992. As of November 5, a total of 85* comments were received to Policy 2520.04, SERIES 44G, Instructional Goals: Science Program of Study. The majority of the comments (70 out of 81) were positive or neutral in nature. The major concerns expressed related to the necessity for staff development, materials, equipment and supplies.

Due to the comments and suggestions received, editorial changes were made to clarify and/or simplify the instructional goals.

IMPACT

The Science Instructional Goals will emphasize the knowledge, skills, and attitudes for students to acquire and be able to function in the Twenty-first Century.

Staff development opportunities must be developed and provided to enable teachers to effectively deliver the science program of study at all levels.

Because the last major initiative to purchase equipment and materials for science was during the 1960's under the National Defense Education Act, materials, equipment, and supplies will be needed to fully implement the science program of study.

*This number represents an additional 70 comments that were received after October 26, 1992.

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TITLE 126
LEGISLATIVE RULE
WEST VIRGINIA BOARD OF EDUCATION
CHAPTER 18-2
SERIES 44G (2520.04)

Title: Instructional Goals: Science Program of Study

Section 1.0 General

1.1 Scope: This policy establishes the instructional goals for the Science Program of Study which sets forth the outcomes expected of students and the basis for the West Virginia Science Curriculum Framework which must be delivered in all schools in West Virginia.

1.2 Authority: West Virginia Constitution Article XII, §2, and West Virginia Code §18-2-5.

1.3 Filing Date: November 19, 1992

1.4 Effective Date: December 20, 1992

1.5 Repeal of Former Rule: Policy 2520.04 is repealed and these regulations will replace the former.

Section 2.0 Purpose

The West Virginia Board of Education has established a systematic, cyclical review of all curriculum and instruction to define specific programs of study. The development of the instructional goals for the Science Program of Study sets forth the expected outcomes in science that students attending West Virginia schools are to achieve. The West Virginia Science Curriculum Framework assures that a high quality curriculum and high quality instructional program will be delivered on an equitable basis to all students grades K-12. All students will develop the attitudes and personal attributes while mastering the knowledge and skills related to science enabling them to be productive citizens in the 21st century.

Section 3.0 Program of Study

3.1 Goals

Science instruction in all science courses (K-12) shall address seven over-arching goals. The over-arching goals are:

NATURE OF SCIENCE - *To develop an understanding of the nature of science (an understanding of scientific inquiry, the nature of the knowledge that scientific inquiry generates, and the scientific enterprise that engages in scientific inquiry).*

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SCIENTIFIC ATTITUDES/HABITS OF MIND - *To cultivate scientific attitudes and values, to develop an understanding of the limits of science, and to evaluate scientific advances and technological applications as they impact society.*

SCIENTIFIC PROCESSES/THINKING SKILLS - *To develop thinking skills and processes for investigating the world, solving problems, and making decisions.*

LABORATORY INVESTIGATIONS/HANDS-ON LEARNING - *To acquire skills for learning through concrete manipulation of the tools and materials of science.*

SCIENCE CONTENT - *To integrate the fields of science and establish connections with other discipline areas and daily life experiences.*

SCIENCE HISTORY - *To develop relationships between scientific milestones and how these milestones influence current scientific thought.*

SCIENCE, TECHNOLOGY, AND SOCIETY - *To develop an understanding of the relationship of science and technology in the context of society.*

3.2 Delivery

The program of study requires a thematic, coordinated science approach at each grade level for all K-10 students. In-depth studies of the natural sciences and in-depth studies of science applications are required elective offerings to students in grades 11 and 12.

Section 4.0 Early Childhood Education (Grades K-4)

4.1 Overview

Children enter the elementary school science program with prior experiences, natural curiosity and intuitiveness. A strong elementary science program nurtures children's innate qualities and abilities by providing carefully selected opportunities to begin to investigate and understand the principles and nature of science. Children are most likely to learn and remember if they are given multiple opportunities to observe and touch the materials of science such as plants, rocks, and magnets. In order to answer their questions about natural phenomena, young children need to use the tools of science such as rulers, scales, and microscopes. By investigating scientific principles again and again, children are able to form and communicate important generalizations. They will appreciate science as a profoundly influential human invention that is subject to on-going interpretation and modification.

Curriculum at K-4 level will:

- Encourage and foster natural inquisitiveness through exploratory and hands-on activities in the physical, earth, and life sciences;
- Provide opportunities for developmental/academic growth;
- Incorporate activities for collecting, organizing and using information in decision making;
- Introduce everyday activities that demonstrate the interrelationship of science and technology;
- Highlight scientific and technological events that have shaped history;
- Encourage creative expression through problem solving activities, and
- Integrate science with other disciplines.

Instruction at K-4 level will:

- Foster exploration, discovery, creativity, and communication;
- Use hands-on, investigative activity-based approaches;
- Consist of varied teaching strategies to accommodate different learning modalities and developmental levels;
- Promote cooperative learning, and
- Provide assessment techniques that utilize observation, manipulative, and problem solving activities.

4.2 Programmatic Goals - Grades K-4

4.2.1 NATURE OF SCIENCE

To develop an understanding of the nature of science, the learner will:

- Perceive science as the humans' search for an understanding of the world;
- Explore objects and events;
- Probe deeply into natural phenomena by communicating and answering questions;
- Realize that science is never finished, and
- Stimulate the joy of discovery about the natural world.

4.2.2 SCIENTIFIC ATTITUDES/HABITS OF MIND

To cultivate scientific attitudes and values, to develop an understanding of the limits of science, and to evaluate scientific advances and technological applications as they impact society, the learner will:

- Demonstrate innate curiosity, initiative, and creativity;
- Be in awe and wonder of natural world;
- Listen to and be tolerant of different viewpoints;
- Trust what the learner observes;
- Continue probing phenomena until questions are resolved, and
- Develop respect and responsibility for the environment.

4.2.3 SCIENTIFIC PROCESSES/THINKING SKILLS

To develop thinking skills and processes for investigating the world, solving problems, and making decisions, the learner will:

- Participate in inquiry-based, manipulative activities that stimulate and develop thinking skills;
- Use logical reasoning, intuition and values for decision making;
- Recognize that science includes both individual and cooperative adventures;

4.2.4 LABORATORY INVESTIGATIONS/HANDS-ON LEARNING

To acquire skills for learning through concrete manipulation of the tools and materials of science, the learner will:

- Use simple scientific instruments and everyday materials to investigate the natural world;
- Demonstrate safe and proper techniques for handling, manipulating, and caring for science materials, and
- Engage in active inquiries, investigations, and hands-on activities for a minimum of 50% of instructional time.

4.2.5 SCIENCE CONTENT

To integrate the fields of science and establish connections with other discipline areas and daily life experiences, the learner will:

- Develop an understanding of scientific themes including systems, changes, and models;
- Integrate physical, earth, and life sciences;
- Establish connections across the curriculum;
- Investigate living things;
- Explore the universe and its changes, and
- Examine the interrelationship between matter and energy.

4.2.6 SCIENCE HISTORY

To develop relationships between scientific milestones and how these milestones influence current scientific thought, the learner will:

- Study the lives and discoveries of scientists, and
- Recognize that science changes over time.

4.2.7 SCIENCE AND, TECHNOLOGY, AND SOCIETY

To develop an understanding of the relationship of science and technology in the context of society, the learner will:

- Use the tools of science effectively and safely;
- Explore scientific careers, and
- Recognize the use of science in everyday life.

Section 5.0 Middle Childhood Education (Grades 5-8)

5.1 Overview

Early adolescents respond well to a challenging middle school science curriculum that includes fundamental scientific and technological concepts and processes developed in a personal and social context. Development of scientific and technological literacy in middle school will include clear indications that science proposes explanations for questions about the world and that technology proposes solutions for problems of human adaptation to the environment. Scientific literacy expands the scientific processes for problem solving, discriminating between inferences, assumptions and solutions, and exploring the social and personal consequences of science and technology.

Curriculum at 5-8 level will:

- Have investigative components;
- Reflect a balance of academic and developmental goals;
- Provide opportunities to gather, organize, evaluate, and apply information for personal decisions;
- Engage students in learning and being able to apply the concepts, skills, and attitudes of science and technology;
- Inform students of the human condition and the forces that shape history;
- Engage students in systematic problem solving, productive and creative thinking, and higher levels of reasoning, and
- Provide opportunities to integrate science and technology.

Instruction at 5-8 level will:

- Consist of varied teaching strategies to accommodate different learning styles and developmental levels;
- Use hands-on, activity based approaches;
- Foster cooperative learning;
- Use group problem solving, and
- Use a variety of performance-based assessments to evaluate the progress of students.

5.2 Programmatic Goals - Grades 5-8

5.2.1 NATURE OF SCIENCE

To develop an understanding of the nature of science, the learner will:

- Acquire a conceptual framework of scientific principles;
- Reflect on and clarify the interrelationships of scientific concepts to everyday life;
- Extend natural curiosity by using scientific attitudes in the critical thinking process;
- Create a holistic view of scientific knowledge, and
- Stimulate a sense of wonder about the natural world and the joy of discovery.

5.2.2 SCIENTIFIC ATTITUDES/HABITS OF MIND

To cultivate scientific attitudes and values, to develop an understanding of the limits of science, and to evaluate scientific advances and technological applications as they impact society, the learner will:

- Become actively involved in the joy of discovery;
- Be open to new ideas;
- Accept the open-endedness of scientific experimentation, and
- Establish habits of close observation, perseverance, and integrity in gathering data and drawing conclusions.

5.2.3 SCIENTIFIC PROCESSES/THINKING SKILLS

To develop thinking skills and processes for investigating the world, solving problems, and making decisions, the learner will:

- Demonstrate the scientific processes including recognition, application, classification, quantification, interpretation, prediction, hypothesis formation, and experimentation;
- Develop rational thinking processes that underlie scientific approaches to problem solving, and
- Develop fundamental skills in the use of laboratory materials and equipment.

5.2.4 LABORATORY INVESTIGATIONS/HANDS-ON LEARNING

To acquire skills for learning through concrete manipulation of the tools and materials of science, the learner will:

- Use scientific instruments and materials to investigate the natural world;
- Demonstrate safe and proper techniques for handling, manipulating, and caring for science materials and equipment, and
- Engage in active inquiries, investigations, and hands-on activities for a minimum of 50% of instructional time.

5.2.5 SCIENCE CONTENT

To integrate the fields of science and establish connections with other discipline areas and daily life experiences, the learner will:

- Develop through the study of interdependent themes including systems, changes, and models an understanding of biological, earth/space, and physical science concepts;
- Associate hands-on activities to daily life experiences;
- Express ideas that illustrate the relevancy of science, technology, and societal issues within the lessons;
- Experience the developmental continuum of science from elementary to secondary levels, and
- Formulate and internalize the conceptual themes of science through interrelating conceptual patterns.

5.2.6 SCIENCE HISTORY

To develop relationships between scientific milestones and how these milestones influence current scientific thought, the learner will:

- Articulate the historical context of contributions in science.

5.2.7 SCIENCE, TECHNOLOGY, AND SOCIETY

To develop an understanding of the relationship of science and technology in the context of society, the learner will:

- Personalize the applications of science and technology, and
- Explore the connections among science, technology, society, and career opportunities.

Section 6.0 Adolescent Education - Grades 9 - 12

6.1 Overview

The mission of the science curriculum for adolescent education prescribes that all students be scientifically literate. To accomplish scientific literacy, a curriculum based on integration of science, mathematics, and technology with an emphasis on thematic concepts shall be utilized. Toward this end, local school districts shall provide learners multiple opportunities to achieve this goal. The ninth and tenth grade program is a continuation of the basic science concepts from kindergarten through grade eight. In grades 11 and 12, in-depth studies in the laboratory-based natural sciences will be provided.

Curriculum at 9-12 level will:

- Prepare students to deal with a world affected greatly by science, mathematics, and technology;
- Instill an appreciation and enjoyment of the natural world;
- Develop a curiosity about the wonders of science;
- Promote an understanding of the concepts and principles of science;
- Prepare learners to become problem solvers;
- Cultivate scientific and mathematical reasoning;
- Communicate the limits of science and technology, and
- Provide options for in-depth studies of the natural sciences and the science applications.

Instruction at 9-12 level will:

- Use hands-on, laboratory based inquiry;
- Incorporate interconnections of mathematics and technology;
- Incorporate thematic approach around systems, changes, and models;
- Build on concepts and skills of science developed at various levels;
- Use a variety of performance-based assessments to evaluate the progress of students;
- Use individual and group inquiry process to complete projects, and
- Provide open-ended problems and experiments.

6.2 Programmatic Goals - Grades 9-12

6.2.1 NATURE OF SCIENCE

To develop an understanding of the nature of science, the learner will:

- Recognize the open-ended structure of science;
- Recognize the limits of science;
- Recognize science as composed of observations set in a testable framework of ideas, and
- Conclude that science is a blend of logic, mathematics, and imagination.

6.2.2 SCIENTIFIC ATTITUDE/HABITS OF MIND

To cultivate scientific attitudes and values, to develop an understanding of the limits of science, and to evaluate scientific advances and technological applications as they impact society, the learner will:

- Cultivate scientific attitudes of curiosity, openness, skepticism, discovery, appreciation, diligence, integrity, fairness, and creativity throughout the science curriculum;

- Use ethical practices of science including established research protocol, accurate record keeping, replication, and peer review, and
- Apply scientific information to personal and societal decision-making.

6.2.3 SCIENTIFIC PROCESSES/THINKING SKILLS

To develop thinking skills and processes for investigating the world, solving problems, and making decisions, the learner will:

- Demonstrate scientific processes including observing, measuring, communicating, comparing, ordering, categorizing, relating, inferring, and applying within a problem-solving setting;
- Use the tools of science safely, accurately, and appropriately;
- Collect, manipulate, analyze, and evaluate data;
- Design, conduct and evaluate experiments, and
- Work cooperatively as well as individually to solve problems.

6.2.4 LABORATORY INVESTIGATIONS/HANDS-ON LEARNING

To acquire skills for learning through concrete manipulation of the tools and materials of science, the learner will:

- Conduct exploration in a variety of traditional and non-traditional educational environments;
- Acquire skills for using the tools of science, and
- Engage in active inquiries, investigations, and hands-on activities for a minimum of 50% of instructional time.

6.2.5 SCIENTIFIC CONTENT

To integrate the fields of science and establish connections with other discipline areas and daily life experiences, the learner will:

- Articulate connections among the major disciplines of science;
- Perform in-depth studies in major scientific disciplines including life sciences, physical sciences, earth/space sciences, and/or environmental sciences in grades 11 and 12, and
- Utilize the thematic approach incorporating the themes: systems, changes, and models.

6.2.6 SCIENCE HISTORY

To develop relationships between scientific milestones and how these milestones influence current scientific thought, the learner will:

- Identify contributors to the scientific body of knowledge;
- Recognize significant scientific events and their impact, and
- Be aware of the evolving nature of scientific thought and models.

6.2.7 SCIENCE, TECHNOLOGY, AND SOCIETY

To develop an understanding of the relationship of science and technology in the context of society, the learner will:

- Apply science and use technology to solve problems;
- Recognize the scientific principles in technological application (the why as well as how), and
- Explore the connections among science, technology, and career opportunities.

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POLICY 2520

Criteria of Excellence: Instructional Goals and Objectives

The State Board of Education believes that the guiding principles of excellence and equity of educational opportunity provide the foundation upon which a learner-based system of educational program development and delivery is built. Further, the board recognizes that the primary goal of such a system is to establish high quality standards concerning performance expectations for all students attending West Virginia public schools.

Therefore, the Board affirms its commitment to a state level learner-based system of educational program development and delivery that ensures that each learner has the opportunity to master the knowledge, skills, attitudes, and behaviors related to state approved programs of study through delivery of approved instructional goals and recommended instructional objectives. These programs of study and instructional goals are periodically reviewed to ensure they meet the developmental needs of students and represent an appropriate scope and educationally sound sequence of learner experiences throughout the public school curriculum.

Policy Adopted: September 14, 1990

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WVDE

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OFFICE OF WEST VIRGINIA SECRETARY OF STATE

TO: Barbara Fox

AGENCY: Board of Education

FROM: JUDY COOPER, DIRECTOR, ADMINISTRATIVE LAW DIVISION

DATE: May 17, 1993

THE ATTACHED RULE FILED BY YOUR AGENCY HAS BEEN ENTERED INTO OUR COMPUTER SYSTEM. PLEASE REVIEW, PROOF AND RETURN IT WITH ANY CORRECTIONS. IF THERE ARE NO CORRECTIONS, PLEASE SIGN THIS MEMO AND RETURN IT TO THIS OFFICE. YOU WILL BE SENT A FINAL VERSION OF THE RULE FOR YOUR RECORDS.

PLEASE RETURN EITHER THE CORRECTED RULE OR THIS FORM WITHIN TEN (10) WORKING DAYS OF THE DATE YOU RECEIVED THIS REQUEST. CALL IF YOU HAVE ANY QUESTIONS.

SERIES: 44G TITLE: 126 Board of Education

* THE ATTACHED RULE HAS BEEN REVIEWED AND IS CORRECT.

SIGNED: _____

TITLE OF PERSON SIGNING: _____

DATE: _____

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* THE ATTACHED RULE HAS BEEN REVIEWED AND NEEDS CORRECTING. THE CORRECTIONS HAVE BEEN MARKED.

SIGNED: Barbara L. Fox

TITLE OF PERSON SIGNING: Education Secretary

DATE: June 7, 1993

NOTE: IF YOU ARE NOT THE PERSON WHO HANDLES THIS RULE, PLEASE FORWARD TO THE CORRECT PERSON.