JOHN ENGLER

STATE OF MICHIGAN
DEPARTMENT OF EDUCATION
LANSING

MICHIGAN Department of Education
THOMAS D. WATKINS, JR.
SUPERINTENDENT OF
PUBLIC INSTRUCTION

July 24, 2002

MEMORANDUM

TO: State Board of Education

FROM: Thomas D. Watkins, Jr., Chairman

SUBJECT: Approval of Standards for the Preparation of Secondary Integrated Science Teachers

In pursuit of its goal to improve teacher quality, the State Board of Education receives proposals for the adoption and revision of program standards for teacher preparation. Proposed standards are developed to reflect and support Michigan's K-12 Curriculum Framework and Benchmarks, as well as standards adopted by national professional/specialty area organizations.

Over the last several years, a referent group reflecting the interests of public and independent teacher preparation institutions and K-12 teachers worked on the development of standards for the preparation of integrated science teachers. The committee began its work by reviewing the Michigan Curriculum Framework for science and standards for the preparation of teachers as developed by the National Science Teachers Association to ensure alignment with both documents. This integrated science (DI) endorsement will replace the current general science (DX) endorsement, which will be phased out of use.

Ongoing feedback from K-12 schools and teacher preparation institutions from 2000 through 2002 was utilized in making significant revisions to an earlier proposal. A draft was forwarded to selected groups/organizations, all Michigan teacher preparation institutions, and a random sample of intermediate and local school districts for review and comment in September 2000. As presented in Attachment 1, the standards reflect the feedback received. Additional information regarding the standards development and review process is provided in Attachment 2.

The proposal was reviewed by the Board-appointed Professional Standards Commission for Teachers and is recommended for adoption by the State Board of Education.

It is recommended that the State Board of Education approve the standards for the preparation of secondary integrated science teachers, as discussed in the Superintendent's memorandum dated July 24, 2002.

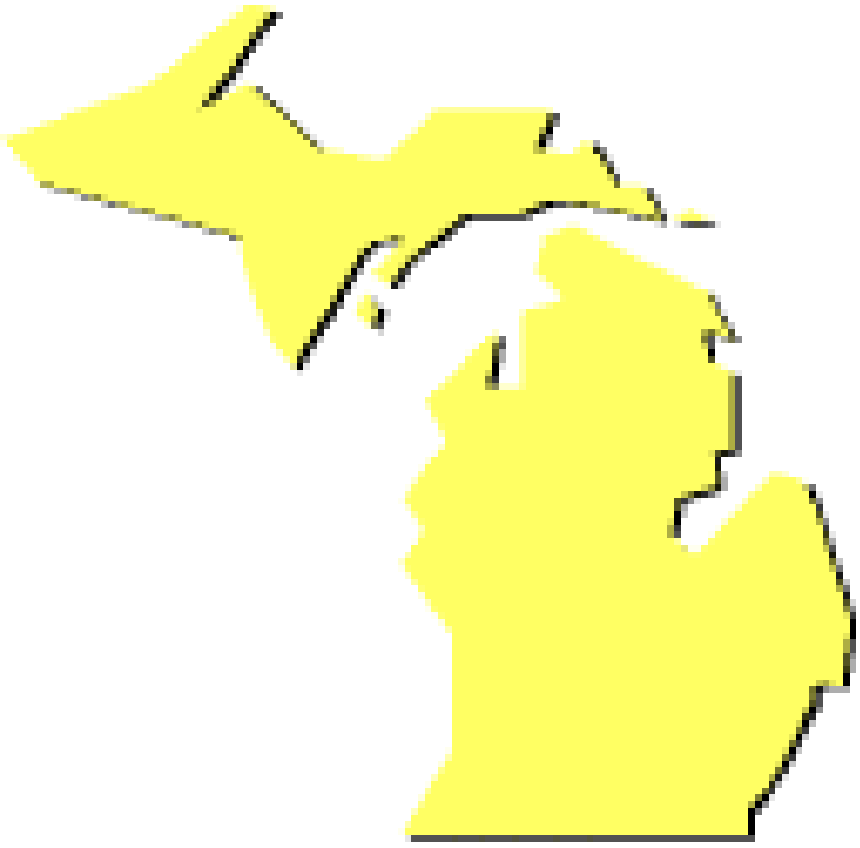
Proposal to the
Michigan State Board of Education
For the Preparation of Teachers

DI
Integrated Science
(Secondary)

Submitted by the
Office of Professional Preparation Services
July 24, 2002

Standards for the Preparation of Teachers

DI
Integrated Science
(Secondary)



Adopted by the Michigan State Board of Education
<date>

Standards for the Preparation of Teachers of Integrated Science (Secondary) DI Endorsement

Preface

Development of the Proposal

Over the last several years, a referent group of professional educators developed a proposal to adopt standards for the preparation of integrated science teachers. These standards align with standards developed by the National Science Teachers Association and the Michigan Curriculum Framework for science education.

A secondary integrated science endorsement prepares candidates to teach integrated science, biology, chemistry, physics, and earth/space science at the secondary level in courses designed to meet the Michigan Curriculum Framework science standards. The preparation of integrated science teachers includes courses of study in each of the three major categories of science identified in the Michigan Curriculum Framework: Life Sciences, Physical Science, and Earth/Space Science. The Secondary Integrated Science Endorsement requires either a group major with a minimum of 36 semester hours distributed among the three major categories for a balance of credits across the areas, or a comprehensive group major with a minimum of 50 semester hours distributed among the three major categories with no additional minor area of study. Candidates who apply for the DI endorsement (secondary) must pass the Michigan Test for Teacher Certification integrated science test at the secondary level for their secondary certificate.

To provide information and gather feedback on the proposal, a copy was also forwarded to selected groups/organizations, all Michigan teacher preparation institutions, and a random sample of intermediate and local school districts for review and comment. As presented in this document, the standards reflect the feedback received.

State Board adoption of these standards typically leads to the creation of a new certification test for teachers prepared to teach secondary integrated science. Test development for a new Michigan Test for Teacher Certification in secondary integrated science will be scheduled according to the recommendation of the Standing Technical Advisory Council.

Approval of Programs

Teacher preparation institutions that wish to continue to offer programs to prepare secondary integrated science teachers are required to submit an application for program approval that demonstrates how the new standards are met throughout the proposed curriculum. The programs must be re-approved to show compliance with the new standards. Following initial approval, the teacher preparation programs will be reviewed every five years through the Periodic Review/Program Evaluation process.

Content Guidelines/Standards Matrix

College/University _____ **Code** DI

Source of Guidelines/Standards Michigan State Board of Education, 2002 **Program/Subject Area** Integrated Science (Secondary)

A – Awareness
The integrated science teacher recognizes/recalls the existence of different aspects of integrated science and related teaching strategies.

B – Basic Understanding
The integrated science teacher articulates knowledge about integrated science and related instructional and assessment strategies.
The integrated science teacher demonstrates proficiency in using the knowledge at a fundamental level of competence acceptable for teaching.

C – Comprehensive Understanding
The integrated science teacher is able to apply broad, in-depth knowledge of the different aspects of integrated science in a variety of settings. (This level is not intended to reflect mastery; all teachers are expected to be lifelong learners.)

An integrated science endorsement prepares a teacher to teach integrated science at the secondary level in courses designed to meet the Michigan Curriculum Framework science standards. The preparation of integrated science teachers includes courses of study in each of the three major categories of science identified in the Michigan Curriculum Framework: Life Sciences, Physical Science, and Earth/Space Science. The Secondary Integrated Science Endorsement requires a group major with a minimum of 36 semester hours distributed among the three major categories for a balance of credits across the areas. Candidates choosing a secondary integrated science course of study may elect a comprehensive group major earning 50 semester hours distributed among the three major categories with no additional minor area of study. Candidates who apply for the DI Endorsement (secondary) must pass the Michigan Test for Teacher Certification integrated science test at the secondary level for their secondary certificate.

DIRECTIONS: List required courses on matrix and provide additional narrative to explain how standards are met. If electives are included, they should be clearly indicated. Adjust size of cells as needed.

	Guideline/Standard	Courses and/or Experiences that Fulfill the Guideline for Secondary Programs	
		36 Semester Hour Major	50 Semester Hour Comprehensive Group Major
	Submit a narrative that explains how this program:		
A.	uses the Michigan Curriculum Framework K-12 Science Content Standards and Benchmarks as the critical foundation for teacher preparation, ensuring that secondary integrated science teachers have the content knowledge and the ability to teach this curriculum; and		
B.	develops an understanding of the interconnectedness of all science, along with major unifying themes, and relates these understandings to the teaching of science; and		
C.	prepares candidates to understand and teach biology, chemistry, physics, and earth/space science as integrated content.		

No.	Guideline/Standard	Level of Proficiency	Courses and/or Experiences that Fulfill the Guideline for Secondary Programs	
			36 Semester Hour Major	50 Semester Hour Comprehensive Group Major
	The preparation of secondary integrated science teachers will enable them to:			
1.0	understand and develop the major concepts and principles of biology, chemistry, earth/space science, and physics, which may include such topics as the following:			
1.1	Cellular Function, including			
1.1.1	cell theory	B		
1.1.2	cell types	B		
1.1.3	cell structure and function	C		
1.1.4	protein synthesis	C		
1.1.5	cell division (mitosis & meiosis)	C		
1.2	Organization of Living Things, including			
1.2.1	life cycles (including sexual and asexual reproduction)	C		
1.2.2	living and non-living	C		
1.2.3	systems	C		

No.	Guideline/Standard	Level of Proficiency	Courses and/or Experiences that Fulfill the Guideline for Secondary Programs	
			36 Semester Hour Major	50 Semester Hour Comprehensive Group Major
1.2.4	classification	C		
1.2.5	growth and development (embryology, etc.)	B		
1.2.6	photosynthesis	C		
1.2.7	cellular respiration	C		
1.3	Concepts of Heredity, including			
1.3.1	Mendelian genetics	C		
1.3.2	traits passed from one generation to the next	C		
1.3.3	molecular genetics (structure of DNA)	C		
1.3.4	modern genetics (electrophoresis, genetic engineering, DNA fingerprinting, etc.)	C		
1.3.5	population genetics	B		
1.3.6	environmental effects on heredity	B		
1.4	Evolutionary Change, including			
1.4.1	diversity/speciation	B		

No.	Guideline/Standard	Level of Proficiency	Courses and/or Experiences that Fulfill the Guideline for Secondary Programs	
			36 Semester Hour Major	50 Semester Hour Comprehensive Group Major
1.4.2	theory of evolution (adaptation, variation, and natural selection and relationships between species, including human)	C		
1.4.3	fossils/ancient life	B		
1.4.4	extinction	B		
1.5	Ecological Systems, including			
1.5.1	community relationships, including predator/prey and symbiosis	C		
1.5.2	population	B		
1.5.3	transfer of energy (food chains/webs)	C		
1.5.4	biogeochemical cycles	C		
1.5.5	human impact	C		
1.6	Human Biology, including			
1.6.1	anatomy and physiology	B		
1.6.2	disease and immunology	B		
1.6.3	health habits	B		

No.	Guideline/Standard	Level of Proficiency	Courses and/or Experiences that Fulfill the Guideline for Secondary Programs	
			36 Semester Hour Major	50 Semester Hour Comprehensive Group Major
1.6.4	resource management	C		
1.6.5	human population growth and diversity	B		
1.7	Earth/Space Science, including			
1.7.1	lithosphere and historical geology	C		
1.7.2	hydrosphere	C		
1.7.3	atmosphere, weather, climate	C		
1.7.4	astronomy	C		
1.8	Chemistry and Physics: Major Concepts and Principles of Physics and Chemistry			
1.8.1	Inorganic Chemistry, including			
1.8.1.1	atomic/molecular structure and bonding	C		
1.8.1.2	stoichiometry	C		
1.8.1.3	gas laws	C		
1.8.1.4	states of matter	C		

No.	Guideline/Standard	Level of Proficiency	Courses and/or Experiences that Fulfill the Guideline for Secondary Programs	
			36 Semester Hour Major	50 Semester Hour Comprehensive Group Major
1.8.1.5	equilibria	C		
1.8.1.6	acid-bases	C		
1.8.1.7	electrochemistry	C		
1.8.1.8	nomenclature	C		
1.8.1.9	qualitative analysis	C		
1.8.2	Organic Chemistry, including			
1.8.2.1	aliphatic and alicyclic reactions	A		
1.8.2.2	stereochemistry	A		
1.8.2.3	structure and nomenclature of major functional groups	C		
1.8.2.4	aromatic compounds	B		
1.8.2.5	spectroscopy	B		
1.8.2.6	heterocyclic compounds	A		
1.8.2.7	polymers	B		
1.8.2.8	biomolecules	B		

No.	Guideline/Standard	Level of Proficiency	Courses and/or Experiences that Fulfill the Guideline for Secondary Programs	
			36 Semester Hour Major	50 Semester Hour Comprehensive Group Major
1.8.3	Physics, including			
1.8.3.1	mechanics	C		
1.8.3.2	electricity and magnetism	C		
1.8.3.3	thermodynamics	C		
1.8.3.4	waves, vibrations, and optics	C		
1.8.3.5	atomic and nuclear physics	B		

No.	Guideline/Standard	Courses and/or Experiences that Fulfill the Guideline for Secondary Programs	
		36 Semester Hour Major	50 Semester Hour Comprehensive Group Major
	The preparation of secondary integrated science teachers will enable them to:		
2.0	apply mathematics, including statistics, to investigations in the sciences, including the analysis of data;		
3.0	relate the study of science to contemporary, historical, technological, and societal issues; in particular, relate the concepts of science to current controversies such as cloning, genetically-modified food, the use of energy, exploitation of resources, global changes, and medical research, as well as other issues;		
4.0	locate appropriate resources, design and conduct inquiry-based open-ended scientific investigations, interpret findings, communicate results, and make judgments based on evidence;		
5.0	construct new knowledge for themselves through research, reading and discussion, and reflect in an informed way on the role of science in human affairs;		

No.	Guideline/Standard	Courses and/or Experiences that Fulfill the Guideline for Secondary Programs	
		36 Semester Hour Major	50 Semester Hour Comprehensive Group Major
6.0	understand and promote the maintenance of a safe science classroom as identified by the Council of State Science Supervisors, including the ethical and appropriate use and care for living organisms and scientific equipment, and the safe storage, use, and disposal of chemicals;		
7.0	demonstrate competence in the practice of teaching as defined within the Entry-Level Standards for Michigan Teachers;		
8.0	create and maintain an educational environment in which conceptual understanding will occur for all science students;		
9.0	develop an understanding and appreciation for the nature of scientific inquiry; and		
10.0	demonstrate competence in the practice of teaching through investigative experiences and by demonstrating the application of the scientific process and in assessing student learning through multiple processes.		

List for Distribution of Draft Standards

Integrated Science (Secondary)
DI

Teacher Preparation Standards Development Committee
for
Biology, Chemistry, Physics, Physical Science, Earth/Space Science,
Integrated Science – Elementary, and Integrated Science – Secondary

Maurice Barnes	Grand Rapids Central High School
Frank Ciloski	Michigan Department of Education
Claudia Douglass	Central Michigan University
Ray Francis	Central Michigan University
David Frank	Ferris State University
Dan Genter	Dansville High School
Jim Hewitt	Saginaw Valley State University
Stanley Hirachi	Central Michigan University
Joseph Krajcik	University of Michigan
David Klingbiel	Dansville High School
Mozell Lang	Michigan Department of Education
Peggy Liggett	Eastern Michigan University
Catherine Smith	Michigan Department of Education
Deborah Smith	Michigan State University
Steven Stegink	Grand Rapids Public Schools
Jane Teska	Southfield Public Schools
Denny Travis	Oakland University
Sue Wittick	Michigan Department of Education

List for Distribution of Draft Standards
Integrated Science (Secondary)
DI

Educational Organizations

Association of Independent Colleges & Universities of Michigan

Directors and Representatives of Teacher Education Programs

* Michigan Association of Colleges for Teacher Education

Michigan Association of Nonpublic Schools

Michigan Association of School Administrators

Michigan Association of School Boards

Michigan Association of School Personnel Administrators

Michigan Association of Secondary School Principals

Michigan Association of Supervision & Curriculum Development

Michigan Association of Teacher Educators

Michigan Congress of Parents, Teachers, and Students

Michigan Deans' Council

* Michigan Earth Science Teachers Association

Michigan Education Association

Michigan Elementary & Middle School Principals Association

Michigan Federation of Teachers & School Related Personnel

Michigan Science Teachers Association

Middle Cities Education Association

Professional Standards Commission for Teachers

* Indicates submission of a response

Teacher Preparation Institutions

Integrated Science (Secondary)
DI

* Adrian College	* Madonna University
Albion College	* Marygrove College
Alma College	* Michigan State University
* Andrews University	Michigan Technological University
Aquinas College	Northern Michigan University
Calvin College	* Oakland University
Central Michigan University	Olivet College
Concordia University	Saginaw Valley State University
Cornerstone University	Siena Heights University
* Eastern Michigan University	* Spring Arbor University
Ferris State University	* University of Michigan – Dearborn
* Grand Valley State University	University of Michigan – Flint
Hillsdale College	University of Detroit Mercy
Hope College	* University of Michigan
* Kalamazoo College	* Wayne State University
Lake Superior State University	* Western Michigan University

* Indicates submission of a response

Local School Districts
DI Integrated Science (Secondary)

Armada Area Schools
Bangor Public Schools
Van Buren Public Schools
Boyne Falls Public Schools
Atherton Community Schools
* Carsonville-Port Sanilac Schools
Clare Public Schools
Constantine Schools
Decatur Public Schools
East China School District
* Engadine Consolidated Schools
Flat Rock Community Schools
Fruitport Community Schools
Grand Marais-Burt Township Schools
Hamilton Community Schools
Hastings School District
* Hanover-Horton Schools
Iron Mountain-North Dickinson County Schools
Kalkaska Public Schools
Lansing School District
Lakeview Community Schools
Mackinac Island Public Schools
Marshall-Mar Lee School District
Middleton-Fulton Schools
Mt. Morris Consolidated Schools
New Haven Community Schools
Okemos Public Schools
Paradise-Whitefish Township Schools
Pinconning Area Schools
Reading Community Schools
Rogers City Area Schools
Scottville-Mason County Central Schools

*Indicates submission of a response

Intermediate School Districts (ISD)
DI Integrated Science (Secondary)

Allegan County
Charlevoix-Emmet
Dickinson-Iron
Huron
Ionia County
Lapeer
Mason-Lake
Newaygo
St. Joseph
Washtenaw

*Indicates submission of a response

NOTE: Additional responses were received anonymously.