Standards for the Preparation of Teachers

Earth/Space Science (DH)

Adopted by the Michigan State Board of Education
August 8, 2002

Standards for the Preparation of Teachers of Earth/Space Science
(DH 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 earth/space science teachers. These standards align with standards developed by the National Science Teachers Association and the Michigan Curriculum Framework for science education. Teachers who receive the endorsement in earth/space science would be prepared to teach any earth/space course at their certificate level.

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 this content area. Test development for a new Michigan Test for Teacher Certification in earth/space 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 earth/space 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.

Submit a narrative that explains how this program:

- uses the Michigan Curriculum Framework K-12 Science Content Standards and Benchmarks as the critical foundation for teacher preparation, ensuring that earth/space science teachers have the content knowledge and the ability to teach this curriculum;
- develops an understanding of the interconnectedness of all science, including biology, chemistry, and physics, and relates this understanding to the teaching of the earth/space sciences.

Levels of proficiency are identified as follows:

A – Awareness

he earth/space science teacher recognizes/recalls the existence of different aspects of earth/space science and related teaching strategies.

B – Basic Understanding

The earth/space science teacher articulates knowledge about earth/space science and related instructional and assessment strategies. The earth/space science teacher demonstrates proficiency in using the knowledge at a fundamental level of competence acceptable for teaching.

C – Comprehensive Understanding

The earth/space science teacher is able to apply broad, in-depth knowledge of the different aspects of earth/space science in a variety of settings. (This level is not intended to reflect mastery; all teachers are expected to be lifelong learner)

The preparation of earth/space science teachers will enable them to:

1.0 understand earth/space science as the study of the earth and its processes and of the interaction between the lithosphere, atmosphere, hydrosphere, and biosphere and the relationship of the earth to the rest of the universe, which shall include such topics as the following:

1.1 Physical Geology
1.1.1 earth and solar system (B)
1.1.2 minerals and rocks (C)
1.1.3 volcanic rocks and processes (C)
1.1.4 weathering and sedimentary rocks (C)
1.1.5 metamorphic rocks (C)
1.1.6 soil formation (B)
1.1.7 mass wasting (C)
1.1.8 geological time, relative and absolute dating (C)
1.1.9 hydrologic cycle (C)
1.1.10 groundwater (C)
1.1.11 glaciers/glaciation (C)
1.1.12 deserts/desertification (B)
1.1.13 crusted deformation (C)
1.1.14 earthquakes/mountain building (C)

1.1.15 folding (C)
1.1.16 plate tectonics/ocean floor (C)
1.1.17 mineral resources (C)
1.1.18 earth's interior (C)
1.1.19 planetary geology (B)

1.2 Historical Geology
1.2.1 history of geology (B)
1.2.2 depositional processes and sedimentary rocks (C)
1.2.3 fossils and fossil records through time (C)
1.2.4 global tectonics through time (C)
1.2.5 origin of the earth and Precambrian era (C)
1.2.6 Paleozoic era (C)
1.2.7 Mesozoic era (C)
1.2.8 Cenozoic era (C)

1.3 Oceanography
1.3.1 origins of the continents, oceans, basins, and plate tectonics (C)
1.3.2 ocean basin physiography (C)
1.3.2.1 sea floor (C)
1.3.2.2 sediments (C)
1.3.2.3 explorations (B)
1.3.3 ocean chemistry (C)
1.3.4 ocean physics (B)
1.3.5 circulation (B)
1.3.6 climate change (C)
1.3.7 ocean waves and beaches (C)
1.3.8 biological oceanography (C)
1.3.8.1 plankton and plants (C)
1.3.8.2 marine life (C)
1.3.8.3 resources (C)

1.4 Meteorology
1.4.1 weather (C)
1.4.2 climate (C)
1.4.3 atmospheric circulation (C)

1.5 Astronomy
1.5.1 celestial spheres and constellations (C)
1.5.2 seasons, solstices, equinoxes (C)
1.5.3 natural laws (C)
1.5.3.1 Copernicus (C)
1.5.3.2 Kepler (C)
1.5.3.3 Newton (C)
1.5.4 solar structure and energy (C)
1.5.4.1 fusion (C)
1.5.5 stars (C)
1.5.5.1 magnitudes and spectra (C)

1.5.5.2 binary stars and masses (C)
1.5.5.3 birth and death of stars (C)
1.5.5.4 white dwarfs and neutron stars (C)
1.5.5.5 novae and supernovae (C)
1.5.5.6 protostars and extra solar planets (C)
1.5.6 galaxy (C)
1.5.6.1 types and classification (C)
1.5.6.2 milky way (C)
1.5.6.3 active galaxies (C)
1.5.6.4 clusters and groups (C)
1.5.6.5 black holes (C)
1.5.6.6 dark matter/nature of (C)
1.5.6.7 big bang and fate of universe (C)
1.5.7 the solar system (C)

The preparation of earth/space science teachers will enable them to:

2.0 apply mathematics, including statistics and precalculus, to investigations in the earth/space sciences and the analysis of data;

3.0 relate the concepts of the earth/space sciences to contemporary, historical, technological, and societal issues; in particular, relate concepts of earth/space science to current controversies, such as those around the use of energy, exploitation of resources, and global change, as well as other issues;

4.0 locate resources, design and conduct inquiry-based open-ended investigations in the earth/space sciences, 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;

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 of scientific equipment, and the safe storage, use, and disposal of materials;

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 demonstrate competence in the practice of teaching through investigative experiences and by demonstrating the application of the scientific processes and in assessing student learning through multiple processes; and

10.0 develop an understanding and appreciation for the nature of scientific inquiry.