

Minutes – Science NRM, March 30, 2016

Negotiated Rulemaking Committee

Science

10am – 5pm, March 30, 2016

Capitol Building, Helena, MT

Present Committee Members

Judy Boyle, K-8 Teacher, Divide

Lorie Carey, District Clerk, Region 4 Director of MT Association of School Business Officials, Boulder

Beth Covitt, Parent & Director, Science Education Research and Evaluation, Spectrum Discovery Area, Missoula

Scott Dubbs, Curriculum Director, Lewistown

Pete Donovan, Executive Director, Board of Public Education

Ann Gilkey, Chief Legal Counsel, OPI

John (Jack) Kirkley, UM Western Professor of Biology, Dillon

Joy-Lyn McDonald, High School Science Teacher, Sidney

Kristy Michael, taxpayer & MT Outdoor Science School Board Member, Bozeman

Theresa Miller, School Board Trustee, Havre

Chris Olszewski, Director of Curriculum & Instruction, Great Falls

Jael Prezeau, Administrator, OPI

Beth Schule, Middle School Teacher, Kalispell

Marissa Spang, taxpayer & Natural Resources Administrator, Northern Cheyenne Tribe

Welcome

Facilitator Dr. Tammy Elser convened the Montana Science Standards Negotiated Rulemaking meeting at 10:07am and Superintendent Juneau welcomed committee members. The Superintendent expressed her gratitude for the committee's time given to review Montana's the science writing team's proposed standards. She reinforced the importance of science as it relates to the skills that students need to think analytically and to prepare for careers in fields such as agriculture, healthcare, and engineering.

Superintendent Juneau noted that the proposed standards are different than the current standards, most notably in the structure. The proposed science standards provide guidance grade by grade through grade 5 and provide grade bands for middle and high school, an important change for elementary teachers without a specific background in science. Superintendent Juneau also noted that the standards were reviewed by MEA-MFT and the Montana Small Schools Alliance after work was completed by the writing team.

It was also noted that the proposed standards do not represent curriculum, nor do they dictate how educators should teach. They provide the minimum standards that should be met, leaving the specific curriculum to local districts. The Office of Public Instruction's (OPI) role will be to provide a model curriculum guide with the standards that school districts may choose to use if they wish.

Superintendent Juneau also informed the committee that once it provides its recommendations to her, she will make the final determination about the science standards and present them to the Board of Public Education to complete the adoption process.

Facilitator, Procedures, and Committee Representation

The committee moved through a series of approvals for the Science Negotiated Rulemaking Process, unanimously approving the facilitator, procedures, and committee representation. Below is the information provided about the facilitator and the day's procedures.

Minutes – Science NRM, March 30, 2016

Facilitator's Role

- Maintain order throughout the meeting
- Assure all members have an opportunity to state their expert opinions
- Restate verbatim, or in summary, a point made by a committee member to assure everyone understands a point of concern or a minor language change
- Restate comments to assure language is accurately recorded by the note taker and the Google Doc manager
- Pose questions related to points of clarification to assure understanding
- Move the committee forward if it becomes clear that consensus cannot be reached (agree to disagree, agreeably) on a concern, while encouraging comments

Consensus

Consensus means a majority of those in attendance for an in-person meeting or a majority of those participating in a meeting held by electronic means.

Proposed Procedures for Negotiated Rulemaking Committee Work

- Each member will be asked to weigh in on each proposed rule in one of the following three categories (all represented in the Google document guiding the committee work):
 - +Good to Go (Green)
 - ?Question or Point of Clarification (Yellow)
 - !Concern (Red)
- For purposes of consensus, 'Good to Go' and 'Questions or Points of Clarification' will be considered as generally agreeing with the language of the rule.
- Each question or point of clarification will be addressed and considered by all members and language change recommendations will be voted on. (This will be noted in the Google Doc as a response to a comment.) A consensus will be needed for a new language recommendation.

Proposed Procedures for Negotiated Rulemaking Committee Work, part 2

- Concerns will also be addressed and discussed by the committee in an effort to achieve consensus. The document will be reviewed once, but deliberations or prolonged points of discussion will be returned to in the second pass.
- If, in the second pass through the document, a concern cannot be resolved in a reasonable amount of time (as determined by the facilitator and committee), the majority will rule and the dissenting committee member(s) will be invited to write a detailed comment for consideration by the Superintendent of Public Instruction.
- The Google Document will serve as a report on committee findings and include all votes and comments.

During the discussion of procedures, it was asked if the meeting was the only time committee members could provide feedback on the proposed standards. It was confirmed that the window for making comments is very limited in order to move the standards through the process in a timely manner. The committee was assured however, that comments and questions raised during the meeting would be recorded in real time in the Google document. The decisions resulting at the end of the day reflect what will be provided as recommendations to Superintendent Juneau, but it was also noted that additional comments can be sent to Jael Prezeau at jprezeau@mt.gov within the 24 hours following the adjournment of the meeting to accompany the recommendations.

Standards Revision Process

Minutes – Science NRM, March 30, 2016

On behalf of the Content Standards and Instruction Division at OPI, Colet Bartow outlined the following standards revision process for the group:

- As outlined by Senate Bill 345, the committee is responsible for reviewing the proposed standards and consensus determines the NRM committee recommendations. Once complete, the recommendations are provided to Superintendent Juneau.
- Superintendent Juneau will review the recommendations and take the final documents before the Board of Public Education (BPE), where it will then work through BPE’s standards revision process until adoption.

It was again reaffirmed that the proposed standards do not represent curriculum, leaving that responsibility to local school boards. The standards are the minimum required requirements of what needs to be taught. Schools can go above and beyond the standards in what they require and teach.

Intro to Economic Analysis

OPI Chief of Staff Madalyn Quinlan presented the following information on the Economic Impact Statement that will accompany the proposed science standards:

- The Economic Impact Statement (EIS) will accompany the proposed science standards and indicate stakeholders and areas financially impacted by the new standards, specifically curriculum, professional learning and staffing.
- At the end of the day, the committee will provide preliminary feedback on the proposed standards’ impact based on the recommendations arrived at in the meeting
- A draft EIS will be prepared by the OPI. Based on today’s feedback and other information from the OPI, a survey will be sent to school districts prior to that second negotiated rulemaking meeting.
- Following the second NRM meeting, the OPI will finalize the EIS and present it to the Education and Local Government Interim Committee.

It was noted that the survey will be distributed the next week, at which time the link to the proposed standards will also be forwarded to the Science Negotiated Rulemaking Committee.

Science Standards Reviewing & Recommendations

Before beginning, the committee was advised that the standards would be reviewed by the following sections and a final committee vote recorded after each section:

1. Physical Science
2. Life Science
3. Earth and Space Science

****Note that not all standards in the document are mentioned in the notes below. Specific standards are referenced under each section only when the committee agreed to make changes to the proposed standards. For a look at the standards as reviewed by the committee, go [here](#).*

IEFA and Science for All K-12 Students Statement

- Change “indigenous knowledge” to “indigenous sciences.”
- Consider rewriting this statement in its totality to respect “indigenous science” and its unique perspective, eliminating the reference to science through the western science frame of reference.

Science Content Standards Introductory Statement

- Simplify the language to read, “Students will learn science with integration of content area ideas, crosscutting concepts, science, and engineering practices, and technology.”

Physical Science Overall Statement

- Revise into the following statement that captures all practices, “Students will use crosscutting concepts, science and engineering practices, and technology while investigating how matter and energy exist in a variety of forms and how physical and chemical interactions change matter and energy.”

In discussion, a concern was raised as to why the proposed standards are not organized like the Next Generation Science Standards (NGSS). It was suggested that the proposed standards be revised to match the NGSS organization to allow teachers to see how Montana’s Science Standards connect to NGSS.

The OPI noted that the vertical articulation present in the NGSS will be referenced in the model curriculum guide released by OPI. Since the guidance document will resolve this issue, the committee agreed that the proposed standards will remain in their current format.

Kindergarten Standard

- Simplify standard to read, “Construct an explanation based on observations of the effect of sunlight on Earth’s surface.”

First Grade

- Change language to, “Make observations to construct an evidence-based explanation....”
- Change standard to, “Design a solution or build a device that facilitates communication over distance using light or sound.”

Second Grade

- Modify statement to read, “Make an observation to construct an explanation of how an object...”
- Use NGSS language and change to, “Construct an argument with evidence that some changes caused by heating or cooling can be reversed and some cannot.”

Third Grade

- No revisions.

Fourth Grade

- Modify standard to state, “Use evidence to describe the relationship between the speed of an object and the energy of that object.”
- Align to NGSS standard and change to, “Make observations to provide evidence of transfer of energy from place to place by sound, light, heat, and electric currents.”
- Use NGSS language and change to, “Develop a model of waves to describe patterns in terms of amplitude and wavelength and that waves can cause objects to move.”

Fifth Grade

- Change standard to “Measure and graph quantities to provide evidence that the total mass of matter is conserved regardless of the type of change that occurs when heating, cooling, or mixing substances.”
- Modify standard to read, “Observe and record qualitative and quantitative evidence to support identification of materials based on their properties.”
- Simplify standard to “Use models to describe that energy in animals’ food was once energy from the sun.”

Minutes – Science NRM, March 30, 2016

6th-8th Grades

- Simplify standard and align to NGSS by removing “multiple sources of data,” leaving the rest as is.
- Use NGSS language and change the following standards to,
 - “Apply Newton’s Third Law of Motion to design a solution to a problem...”
 - “Plan an investigation to provide evidence that the change in an objects’ motion depends on the sum...”
 - “Design and conduct an investigation to provide evidence that fields exist between objects...”
 - “Use mathematical representations to describe a simple model for waves that includes now the amplitude and wavelength of a wave is...”

9th – 12th Grades

- Clarify statement by using NGSS language, “Plan and conduct an investigation to gather evidence to compare the structures of substances at the bulk scale...”
- Modify to “Develop a model to illustrate the changes in the composition of the nucleus of the atom and the energy released during the processes of fission, fusion, and radioactive decay. “
- Change the next five standards from plural to singular with the following revisions:
 - “Construct and revise explanations for outcomes of a simple chemical reaction...”
 - “Develop a model to illustrate that the release or absorption of energy from a chemical reaction is dependent...”
 - “Apply scientific principles and evidence to provide an explanation...”
 - “Refine the design of a chemical system by specifying a change in conditions...”
 - “Use a mathematical representation to support claims...”
- Use NGSS and change the following standards to,
 - “Analyze data to support the claim that Newton’s Second Law of Motion describes the mathematical relationship among the net force on a macroscopic object...”
 - “Apply scientific and engineering ideas to design, evaluate, and revise a device that minimizes the force on a macroscopic object during collisions.”
 - “Create a computational model to calculate the change in the energy of one component...”
 - “Plan and conduct investigations to provide evidence that the transfer of thermal energy when two components...”
 - Develop and use a model of two objects interacting through electric or magnetic fields to illustrate...”
 - “Use mathematical representations to support a claim regarding relationships among the frequency...”
 - “Evaluate the claims, evidence, and reasoning behind the idea that electromagnetic”
 - “Evaluate the validity and reliability of claims in published materials...”

The committee unanimously voted to accept the Physical Science standards with the above noted changes and recommendations.

Life Science Introduction

Revise two statements into one that reads “Students will use crosscutting concepts, science and engineering practices, and technology while investigating the characteristics, structures, and functions of living things; the processes and diversity of life; and how organisms interact with each other and their environments.”

Kindergarten

- Change standard to NGSS language, “Use observations to describe patterns of what plants...”

Minutes – Science NRM, March 30, 2016

First Grade

- Align with NGSS language and change to, “Make an evidence-based explanation of how young...”

Second Grade

- No revisions.

Third Grade

- Align to NGSS by removing “multiple sources of data,” and changing the following standards to,
 - “Construct an argument with evidence that in a particular habitat some organisms can survive well...”
 - “Construct a cause and effect argument communicating some animals, including humans, form...”
- Change the following standards to NGSS language,
 - “Analyze and interpret data from fossils to provide...”
 - “Develop models to evaluate organisms which have unique and diverse life...”
- Align to NGSS by removing “from multiple sources” and change the following standards to,
 - “Analyze and interpret data to provide evidence...”
 - “Use evidence to construct an explanation for how...”
- Change standard to NGSS language that reads, “Use evidence to construct an explanation for how variations in characteristics...”

Fourth Grade

- Remove “viable” from “Construct a viable argument”

Fifth Grade

- Remove “viable” from “Construct a viable argument”
- Change standard to read, “Develop and critique a model to describe the movement...”

With the reference to modeling in the previous standard, Marissa Spang questioned why the standards document doesn’t contain any standards that refer to students interacting with nature. She identified modeling as a very theoretical and western science perspective that limits students’ learning. Allowing students to go outside provides a richer experience that engages them with nature in meaningful ways. She further contended that this is where indigenous science and western science diverge, with the former built on a genealogical narrative built from a relationship to the natural world. This indigenous perspective recognizes that science cannot be lived and learned without practicing and living it – a perspective that needs to be equally valued when approaching standards for what students need to learn.

Jack Kirkley noted that experiences in nature are usually provided for by curriculum guides, but agreed that the standards must also reinforce the idea of students’ interacting with nature. Absent a reference here, however, the curriculum guide will need to encourage that.

Judy Boyle shared that she has been using the NGSS framework with her students, which has allowed them to become scientists in nature. The students discover, fail, retry, and succeed. She confirmed that as a result, she has watched her students increase their engagement and their assessment scores.

Minutes – Science NRM, March 30, 2016

Grades 6-8

- Use NGSS language and change to “Conduct an investigation to provide evidence that living things are made...”
- Consider revising standard to either, “Develop and use a model to describe the structure and functional of a cell as...” or “Develop and use a model to describe the function of the cell as a whole and the ways...” No consensus reached on this standard.
- Align to NGSS by removing “from multiple sources” and change the following standards to,
 - “Use argument supported by evidence for how...”
 - “Construct a scientific explanation based on evidence for the role...”
- Change standard to align with NGSS, “Develop a model to describe how food is rearranged through chemical reactions forming new molecules that support growth and/or release energy as this matter move through an organism.”
- Align to NGSS by changing to, “Analyze and interpret data to provide evidence showing the cause and effects of resource availability on organisms and populations of organisms in an ecosystem.” Change to NGSS Language
- Revise standard to read, “Examine scientific practices used by American Indians to maintain healthy relationships with the natural world.”

Marissa Spang again voiced concern at the references to American Indians in the proposed standards document. She argued that the nature of the inclusion places indigenous science in the context of western science, devaluing the diversity of indigenous people’s relationships to diversity and the land. Indigenous science sees humans as a part of nature. In that regard, humans have an obligation to treat the environment with respect, which is very different from the western approach of extracting resources and knowledge.

Following Marissa’s comments, it was again noted that committee members could share additional thoughts via email following the close of the meeting.

- Modify standard language to, “Construct a scientific explanation based on evidence of how environmental and genetic factors influence the growth and development of organisms.”
- Revise standard to read, “Develop and use a model to describe why structural changes to genes, such as mutations, may affect proteins and may result in harmful, beneficial, or neutral effects to the structure and function of the organism.
- Align to NGSS and remove “from multiple courses” so the standard reads, “Construct an explanation based on evidence that describes how genetic variations of traits in a population...”

9th – 12th Grade

- Align to NGSS and remove “from multiple sources” so the standard reads, “Construct an explanation based on evidence for how the structure of DNA...”
- Use NGSS language and change standard to “Plan and conduct an investigation to provide evidence that feedback mechanisms...”
- Modify like NGSS standard, removing the last phrase “which are the basis of life”
- Align standard to NGSS by removing “from multiple sources” and “conditions through an ecosystem”
- Change standard to “Use mathematical representations to support claims for the cycling of matter...”
- Revise standard to read, “Use mathematical or computational representations to support arguments about environmental factors that affect carrying capacity...”
- Change standard to “Examine scientific concepts used by American Indians to maintain healthy relationships with the natural world.”

Minutes – Science NRM, March 30, 2016

Prior to revising the standard relating to American Indians' relationship to the world, biotic and abiotic were challenged and discussed. Marissa Spang shared her perspective that the idea of biotic versus abiotic directly contradicts indigenous science's perspective that everything is alive. Using terms such as this subtly assimilates American Indian students into western science. Indigenous science teaches that humans have the responsibility to attend to the natural world because it is not separate from humans.

This discussion prompted a recommendation to examine the inclusion of IEFA in the standards. Specifically, the committee was concerned that the IEFA component is just an "add-on" and not fully integrated to respect indigenous science.

- Encourage the revision of the standard, "Evaluate and communicate specific information about how common ancestry and biological evolution are supported by multiple lines of empirical evidence."
- Align to NGSS and remove "from multiple sources, including primary sources" from "Construct an explanation based on evidence that the process of evolution by natural selection primary results from four factors..."
- Change standard by removing "experience less selective pressure causing shifts in numerical distribution of traits," and replace with "increase in proportion to organisms lacking this trait."
- Use NGSS standard, "Construction an explanation based on evidence for how natural selection leads..."
- Remove "from multiple sources, including primary sources" so the standard reads "Evaluate the evidence supporting claims that changes in environmental conditions may result in..."
- Modify standard to "Investigate and explain American Indian perspectives and practices on changes in the natural world."

The committee again expressed concern that the inclusion of American Indians as written throughout the document doesn't equitably represent indigenous science.

The committee unanimously voted to accept the Life Science standards with the above noted changes and recommendations.

Earth and Space Science Introduction

- As with the previous two sections, combine the two introductory sentences into one with parallel language and style.

Kindergarten

- Change standard to align with NGSS, "Construct an argument supported by evidence for how plants and animals..."
- Use NGSS and modify the standard to, "Use models to represent the relationship between the needs of different plant or animals, including humans, and the places they live..."
- Change standard to read, "Communicate ideas about the impact of humans on the land, water, air, and other living things in the local environment."
- Modify standard by removing "from at least one source," to read "Ask questions to obtain information about the purpose of weather forecasting to predict, prepare, and respond to weather."

First Grade

- Align to NGSS and change to, "Make observations at different times of the year to relate..."

Second Grade

- Use NGSS and change to "Use information from several sources to provide evidence that Earth..."

Minutes – Science NRM, March 30, 2016

- Change standard, “Construct explanations...which impact wind or water’s effect on the shape...” to read, “Compare solutions designed to slow or prevent wind or water from changing the shape of the land.”
- Revise standard to match NGSS, “Obtain information to identify where water is found on Earth and that it can be solid, liquid, or gas.”

Third Grade

- Remove “from multiple sources” and “from a variety of sources” from standards in this section

Fourth Grade

- Change to match NGSS, “Make observations or measurements to provide evidence of the effects of weathering or the rate of erosion by...”
- Drop “qualitative and quantitative observations” and replace with “observations or measurements” to match NGSS.

Fifth Grade

- Simplify and use NGSS standard, “Develop a model using an example to describe ways the geosphere...”
- Change standard referencing American Indians to read, “Investigate and describe examples of how American Indian scientific knowledge and practices are used to maintain relationships with the world.”
- Re-examine “Describe unique cultural perspectives of American Indians regarding astronomy.”

6th-8th Grades

- Modify the end of the standard to “at varying time scales and spatial scales.”
- Review the standard “Understand historic and contemporary impacts upon indigenous populations,” to highlight proportional impact on indigenous populations and how they are responding to local and global issues.

9th-12th Grade

- Remove “multiple sources” where present in this section.
- Re-examine “Analyze sources from American Indians that support scientific concepts and understandings regarding the Earth’s formation” as the language may set up a conflict.
- Revise standard to read, “Develop a model to illustrate how Earth’s internal and surface processes operate at different spatial and time scales...”
- Add language to the standard to read, “Create a computational simulation to illustrate the relationships among management of natural resources...”
- Revise standard pertaining to American Indians and natural resources to read, “Investigate and explain how some American Indian tribes use traditional knowledge and science practices to sustain relationships with the natural world.”

The committee unanimously voted to accept the Life Science standards with the above noted changes and recommendations.

Following the approval of the three sections, the committee asked why the engineering and technology standards are not included in this proposed standards document.

OPI Special Projects Director Terry Kendrick explained that the Superintendent believes the engineering and technology content is close to curriculum, and their inclusion would also adversely impact smaller schools who

Minutes – Science NRM, March 30, 2016

do not have large budgets to devote to technology. It was noted that engineering and technology will be included in the model curriculum guide that the OPI releases.

Several committee members shared their concerns with leaving technology and engineering standards out of the final standards, arguing it would limit schools ability to apply for grants, but most importantly students' ability to compete and prepare for today's careers. Those with concerns were advised to email any concerns or comments about this issue and others covered today to jprezeau@mt.gov in the next 24 hours.

Economic Impact Discussion

Madalyn Quinlan again addressed the group, asking for preliminary thoughts on how the standards would impact schools.

The following is a list of potential impacts shared by the committee.

- Professional Learning will need to address:
 - Native science with examples of classroom practice
 - What the standards are and mean in a non-threatening way in order to empower teachers and give them confidence in teaching.
 - Ideas for resource collaboration within districts and regions.
 - Content-based professional development for K-5 teachers
 - shifting the discussion from activities to content
 - acknowledging that students bring knowledge and teachers facilitate growth
 - Accessibility to resources for the more rural and remote areas of the state
 - Educating school administrators about the classroom changes to expect from the new standards
- Curriculum considerations:
 - Many districts have shifted to a more inquiry-based science approach already, but will need to revisit alignment and maybe reorder curriculum materials
 - OPI's rollout, whether through regional trainings or model curriculum guides, will be essential to demonstrate inexpensive ways that teachers can implement the changes.
- Staffing Considerations:
 - Smaller schools could potentially be impacted

Public Comment

No public comment was received.

The facilitator thanked the committee for their work throughout the day, and the meeting adjourned at 5:42pm.

Submitted by:
Tara Steinke
4/6/2016