

Negotiated Rulemaking Committee

Science

10am – 5pm, May 9, 2016

Capitol Building, Helena, MT

Present Committee Members

Judy Boyle, K-8 Teacher, Divide

Kathleen Harder-Brouwer, School Board Trustee, Corvallis

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

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

Gerry Wheeler, Bozeman, Emeritus, MSU Professor of Physics

Welcome

Facilitator Tammy Elser convened the meeting at 10:03am and thanked committee members for meeting again to provide recommendations on the economic impact of Montana's proposed standards.

OPI Administrator Jael Prezeau read a statement from Superintendent Denise Juneau, who was unable to attend the meeting. The Superintendent expressed her regret that she could not attend the meeting, and thanked the committee for its thoughtful work on the standards, noting that most of the committee's recommendations were accepted. With regard to the Indian Education for All language, changes were made to the language and were approved by the Montana Advisory Council on Indian Education. Superintendent Juneau reinforced the idea that these standards reflect the skills needed for all Montana students, regardless of district size.

Review of March 2016 Meeting and Discussion

The committee was led through a review of the results of the March 30, 2016, meeting and notified that Superintendent Juneau reviewed the recommendations from that meeting and either accepted or rejected the committee's recommendations.

The committee was reminded of the following facts with regard to the science standards:

- The current standards were adopted in 2006.
- The proposed standards move from general content standards across all science disciplines to three distinct disciplines: earth and space science, physical science, and life science.
- The proposed standards emphasize that students will learn science by connecting science content across the three disciplines and applying design practices and technology to solve problems
- The revised standards are organized by grade level for grades K-5, and by grade band for grades 6-8 and 9-12.

- Grade level standards for K-5 clarify learning expectations for elementary teachers who teach in all content areas.
- Grade band standards for grades 6-8 and high school clarify expectations and allow flexibility of staffing and program delivery.
- The proposed standards integrate Montana’s Indian Education for All.

The committee was then given time to provide input on the current proposed standards that reflect Superintendent Juneau’s recommendations:

American Indian References

- Gerry Wheeler recommended that the phrase “American Indian scientific knowledge” be replaced because there are a set of hard and fast rules that outline what science is and “American Indian scientific knowledge” does not meet those criteria. The phrases “cultural knowledge” or indigenous ways of knowing” were offered as alternatives. He noted that the phrase “astronomical knowledge is used by American Indians” is an example of an accurate integration of American Indian knowledge.
- Jack Kirkley agreed with Gerry and identified the following phrase as problematic: “...describe examples of how American Indian scientific knowledge and practices...” (earth & space science, Fifth Grade). He suggested instead that it should be rephrased to read, “...how American Indians use scientific knowledge”.
- Chris Olszewski noted that the state has a responsibility to recognize things through the American Indian lens. There appears to be a dichotomy between science and American Indian indigenous knowledge, and the science standards document needs to provide a balance between the two. The American Indian perspective brings an inductive reasoning piece that needs to be retained in these standards with accompanying guidance so that teachers feel empowered to teach the nuances and culture.
- Marisa Spang voiced her thoughts on the incorporation of language regarding American Indians highlighting the following:
 - IEFA is such a critical guarantee because it creates opportunity for non-predominant students to learn according to indigenous ways of knowing. Western science is a euro-centric view that dominates science and encourages assimilation. It creates discouragement and inequities in learning for American Indian students.
 - Methodology Example: Western science emphasizes the connection to writing, while American Indians use oral traditions. Just because this is a different methodology for practicing science doesn’t make it any less valuable.
 - When referring to American Indian knowledge and practices in the proposed standards, “indigenous scientific knowledge” should be used because it captures the American Indian perspective as valuable in its own right.
 - It is critical to understand that science is cultural. It’s a cultural way to understand and practice in the world. By understanding that science is a human cultural practice, this can inform our children and student’s learning.
- Gerry agreed with Marisa that that the science standards must not devalue indigenous ways of knowing. However, the document itself fits around western ways of knowing and science has a set of attributes that clearly define what science is. Recognizing the value of indigenous ways of knowing and also keeping the standards free from legal issues, he suggested using the phrase “indigenous ways of knowing”.

Life Science Fifth Grade, Plant Growth Standard

- Jack Kirkley questioned why soil nutrients is not included with air and water in the standard referring to plant growth.
- Beth Covitt provided support for the standard as is, highlighting the reference to what plants “chiefly” need for growth. She explained that 96% of a plant’s mass comes from water and air, not soil nutrients.

Tammy Elser thanked the committee members for their discussion. Jael Prezeau informed the committee that this dialogue is useful for the process moving forward and confirmed that the day’s discussions would be taken under advisement by Superintendent Juneau. It was also noted that at each of the remaining steps, there are more stakeholder groups that will be involved in this open process, including the Board of Public Education and the public.

The committee members were then asked to provide an overall sense of the proposed science standards.

Jack Kirkley shared that the vast majority of the changes are positive, but given the American Indian language he reference earlier, he could not wholeheartedly support them.

Beth Covitt shared that she has concerns about the lack of engineering standards and for that reason could not completely support the standards either.

Overall, some members of the committee noted they still have concerns, but all noted that the proposed standards in their current form had come a long way from the original document.

Economic Impact Statement Report

Madalyn Quinlan provided an introduction to the Economic Impact Statement (EIS) report to the group. The EIS is required by statute and reports on the areas that are required as part of the negotiated rulemaking process, in order to identify any potential costs as a result of the proposed science standards.

OPI’s draft EIS was shared with the committee. In preparation for the committee to provide its recommendation, Madalyn Quinlan provided background on the process used to prepare the EIS. The committee was then walked through the findings of the survey, and lastly, a more in depth discussion of information contained in the EIS.

Process

- School districts across the state were invited to answer a 20 question survey about the science standards. The window was open from April 12 to May 3 for representatives to review the current and proposed standards and respond to the survey.

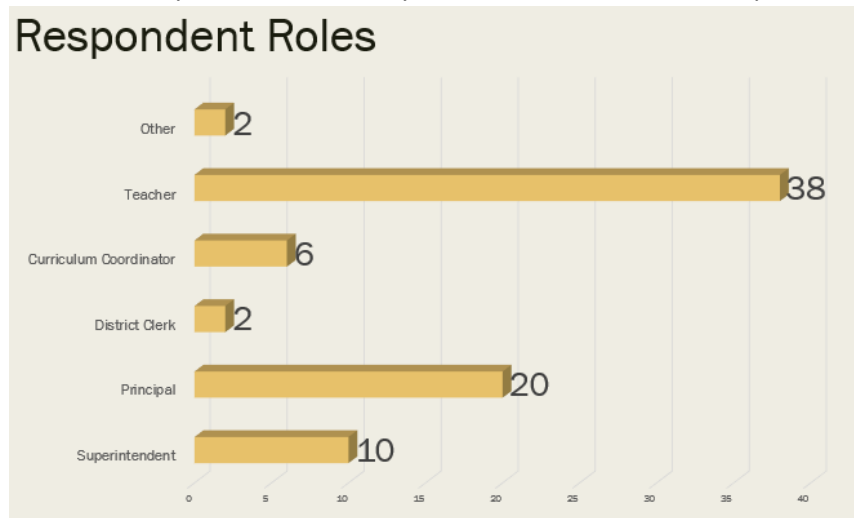
Findings

- 79 school systems answered the survey
 - It was noted that ‘independent elementary’ means that that the school is a K-8 district without a high school.

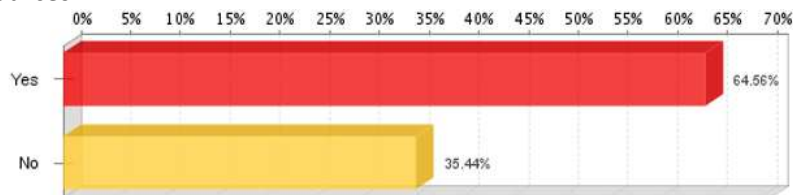
Response Demographics

Type of District	Responses
Independent Elementary	6
Independent High School	3
K-12 System	12
District Size	Responses
Large School System (AA)	4
Medium School System (2E-4E)	33
Small School System (5E-6E)	10

- Most surveys were filled out by school and district leadership and teachers



- 65% of survey respondents anticipate that their district will be able to meet the proposed standards with existing resources.



- Districts that answered that “yes” (they anticipated meeting the proposed standards with existing resources) were directed to the end of the survey to provide any comments they wanted to share.
- Respondents that answered with “no” were led through questions specific to instructional materials, personnel, professional development, and time and resources for curriculum development.

A Closer Look at Draft EIS Report

Madalyn Quinlan continued the discussion by walking the committee through the main sections of the EIS, which follows a specific reporting template as determined by Montana law.

The following main ideas were shared from the EIS specific to the implications of the new standards and their impact on Montana and its students:

- The focus of the proposed science standards is on building standards that are high quality and prepare students for college and career.
- A majority of survey respondents indicated they could meet the proposed science standards with existing resources in the areas of curriculum development, professional development, instructional materials, and staff.
 - Most respondents who indicated they would have a hard time meeting the proposed standards in these areas have difficulty meeting the current standards.
- The cost of the new standards will be borne by schools and the OPI, however the OPI is dedicating \$478,160 to support professional development around the standards through:
 - developing regional teacher leaders in science,
 - providing regional face-to-face trainings lead by teacher leaders,
 - offering online science standards courses on the Teacher Learning Hub,
 - providing professional learning at the state’s many science conferences hosted by Montana’s, professional science organizations, and
 - developing a model curriculum guide for the science standards.

Jael Prezeau continued the discussion by elaborating on the professional development that OPI will provide.

A Look at OPI-Provided Professional Development

A brief explanation of the Content Standards Division was provided. The division provides leadership and support for equitable access to teaching and learning and is currently helping with the revision of three sets of content standards – science, arts, and health and physical education.

The Content Standards and Instruction Division has been working on the following two goals to support teaching and learning:

- Improving communication and awareness to Montana’s 824 schools, including information about standards and instructional strategies that will meet those standards. This has been facilitated through:
 - [3 Big Ideas Email](#)
The 3 Big Ideas is a weekly email that shares instructional resources, educational articles, learning opportunities, and other educational support.
 - [Learning Opportunities Portal](#)
The Learning Opportunities Portal gives educators information about professional learning opportunities, both in person and online. It has a calendar for events that are scheduled, and a catalog that helps schools find providers and workshops that fit their needs.
 - [Teacher Learning Hub](#)
The Teacher Learning Hub is an online learning platform that has self-paced courses, facilitated courses, and a video library aimed at providing teachers learning support across all content areas. Courses meet high quality online learning criteria, are offered free of charge, and are teacher-developed and facilitated. The Hub offers a variety of courses to support learning for the whole student from academics to school climate. Since November, over 6,000 renewal units have been issued, and the OPI is continually collecting feedback from educators to keep the Hub high quality and relevant.

- Building an infrastructure to support teachers through communication, coordination, and collaboration with learning providers and schools.

The infrastructure includes:

- Content Standards Liaisons who attend monthly Montana Association of School Superintendents meetings to share professional learning information with schools and learn what schools need from the OPI.
- Partnership grants that are helping create content and bring support to teachers regionally through Teacher Leadership networks:
 - The Math and Science Partnerships (MSP) grant has funded the [MPRES project](#) (Montana Partnership with Regions for Excellence in STEM) that has served and trained over 700 teachers through the teacher trainer model.

Committee member Judy Boyle spoke about the MPRES project as one of its trainers. MPRES develops teacher leaders in science by re-orienting them as facilitators rather than teachers, to facilitate science instruction in classrooms that has students doing science and learning as scientists.

- MSP-LEAD supports the development of regional teachers through a collaborative effort with the OPI and Montana university systems. It focuses on building “soft skills” in teacher leaders, such as grant writing and presenting to adults.
- NESSP (Northwest Earth and Space Science Pipeline) is a NASA-funded consortium that includes the OPI and Montana State University to build STEM support for teachers and students. As part of this project the OPI is building regional teacher workshops and online NASA courses in collaboration with teacher leaders.

Small Group Discussion – Professional Development and Instructional Materials

After hearing from Jael Prezeau, the committee split into three teams to identify both “basic” and “optimal” support for professional development and instructional materials around the science standards.

Before breaking into small groups, a question was posed by the committee as to the amount of funding received for implementing the Montana Common Core Standards for Math and English Language Arts.

It was noted that funding was requested from the Montana Legislature, but was not given. However, the OPI did receive a grant supported by the Helmsley Foundation, as well as about \$500,000 over four years from GEAR UP to support implementation. Additionally during this time, the legislature provided a substantial increase in funding to schools with language that was generically worded to support standards implementation.

Science Small Group 1

- Jael Prezeau, Division Administrator, OPI Content Standards and Instruction
- Kathleen Harder-Brouwer, Corvallis, School Board Trustee
- Judy Boyle, Divide, K-8 Teacher
- Lorie Carey, Boulder, District Clerk, Region 4 Director of MT Association of School Business Officials
- Gerry Wheeler, Bozeman, Emeritus, MSU Professor of Physics

Chart Paper Notes

Materials and Resources	
Basic	Optimal
<p>K-5</p> <ul style="list-style-type: none"> • Most needy because science isn't taught • Need basic resources • Not textbooks • Resources to support inquiry and learning <ul style="list-style-type: none"> ○ K-8 Science Framework ○ Library resources/internet <p>6-8</p> <ul style="list-style-type: none"> • Lab space and basic equipment • Library resources • K-8 Science Framework • Access to online resources <p>HS</p> <ul style="list-style-type: none"> • Lab room + equipment • Engineering equipment • Library resources • Internet • Connection to IHE experts • OEP and High-quality materials 	<p>K-5</p> <ul style="list-style-type: none"> • Ongoing structure to support getting integrated resources for each teacher's classroom • Money for Field work/studies • Laptop for each students <p>6-8</p> <ul style="list-style-type: none"> • Dedicated lab • Laptop each student • Software supported for each student • Money for Field work/studies <p>HS</p> <ul style="list-style-type: none"> • E-Books and laptop per student • Lab wing, outdoor classroom, greenhouse • Exemplary resources with leaders in the field
Professional Development	
Basic	Optimal
<ul style="list-style-type: none"> • Group PD for teachers (on new standards) • Time set aside for PD on new standards • Place for individual PD (electronic options like the Hub) • Different levels need different things <ul style="list-style-type: none"> ○ K-5 Content ○ 6-8 Content and Pedagogy ○ 9-12 Pedagogy • Teachers/scientists • All MT schools • One or the other- online OR face to face PD options 	<ul style="list-style-type: none"> • Meeting the individual needs of all teachers of science • PL communities that are embedded and have sustained, ongoing dialogue over a period of time • Electronic PD options combined with coaching and/or mentoring • Different levels need different things <ul style="list-style-type: none"> ○ K-5 Individual teacher's needs in content and/or pedagogy ○ 6-8 (same as above) ○ 9-12 (same as above) ○ Preservice teachers: need content and pedagogy ○ Rural school teachers need different PD from large districts • Blended learning opportunities for all teachers

Additional Notes from assigned note-taker, Christy Mock-Stutz, OPI CSI

- Work closely with the Montana Small Schools Alliance to prepare support materials for teachers in small schools.
- Provide differentiated basic information for teachers in elementary, middle and high school. They have different content and pedagogical needs. Generally, elementary teachers need more support with content, while HS teachers need more support with pedagogy and how to teach students to be independent scientists.
- Address the idea of complacency. Teachers sometimes do not want to change with the “next” wave of something “new” like the standards.
- Create Professional Learning Communities of teachers and have support for them be on-going
- Universities need to prepare pre-service teachers differently.
- Partner with librarians to ensure libraries are full of rich, content-area texts and primary sources will be the key to teaching without a textbook.
- Form partnerships with scientists in the community

Science Small Group 2

- Chris Olszewski, Great Falls, Director of Curriculum and Instruction
- John (Jack) Kirkley, UM Western Professor of Biology, Dillon
- Beth Schule, Middle School Teacher, Kalispell

Chart Paper Notes

Materials and Resources	
Basic	Optimal
<ul style="list-style-type: none"> • Model Lesson Guide <ul style="list-style-type: none"> ○ NGSS aligned ○ Supportive of grade-level activities in the new MT science ○ Integrate multi-disciplinary approaches & lessons • Hands-on, experiential Learning • Simulations/models (NSTA, NSF, etc.) • Budgets for consumables • Not always focused on a textbook <ul style="list-style-type: none"> ○ Text accessible to age/grade levels ○ Make it relevant/local 	<ul style="list-style-type: none"> • Field Trips/Buses • Visiting science professionals • Online simulations & models identified and shared (HUB?) • Technology, Device, bandwidth allocation • Data collection Tools (probes, equipment, etc.)
Professional Development	
Basic	Optimal
<ul style="list-style-type: none"> • Model Lesson WKSPS • In-depth content training • Level I <ul style="list-style-type: none"> ○ Awareness of Standards ○ Scope and sequence • Administrative PD • Integration of multi-disciplinary lessons • Adoption and Implementation by Grade level • Finding raw data & learning what to do with it • “Doing” Science • Make it relevant/local 	<ul style="list-style-type: none"> • Partnerships between K-12 & the higher-ed to build elem ed content background (beyond methods courses) • Additional Time beyond basic PIR requirements/allowances • Longer Timelines for implementation

Additional Notes from assigned note-taker, Michelle McCarthy, OPI CSI

- Content training is important for elementary teachers (also model lessons to “do science”)
- Make connections with universities
- Administrators must be included in professional development so they know what good science instruction looks like
- Fieldwork for students is key for students to learn content while seeing its application to the real world; building integration and partnerships between the school and community

Science Small Group 3

- Scott Dubbs, Lewistown, Curriculum Director
- Beth Covitt, Missoula, parent and head of science education research and evaluation at Spectrum Discovery Area
- Ann Gilkey, OPI Chief Legal Counsel
- Pete Donovan, Board of Public Education Executive Director
- Joy-Lyn McDonald, Sidney, High School Science Teacher

Chart Paper Notes

Materials and Resources	
Basic	Optimal
<ul style="list-style-type: none"> • Document Cameras • Probes/sensors • Data Analysis equipment and software • Curriculum guides • Lesson-based, standards-aligned curriculum • Crosswalk between NGSS and MT Standards • OER collections curated for grade level, topic, lessons, units • \$ for MT educators to put materials together • Broadband to support online access • Survey to create directory 	<ul style="list-style-type: none"> • STEM Experts Directory <ul style="list-style-type: none"> ○ Educators ○ Professionals ○ Informal
Professional Development	
Basic	Optimal
<ul style="list-style-type: none"> • Teachers learning from each other • Focus on K-5 for content & instructional strategies • High-quality Assessments <ul style="list-style-type: none"> ○ Formative ○ Summative ○ **Performance • Teachers become scientists • Individualized PL plans • Connect with MSTA and other Professional Organizations • Connect to MUS 	<ul style="list-style-type: none"> • Science Specialists to support K-5 teachers • Instructional Model • Professional Growth Plans • Pre-service and Early Service Mentoring

Additional Notes from assigned note-taker, Colet Bartow, OPI CSI

- Encourage conversations between teachers of science, share best practices

- Create professional learning communities within and across districts— including connecting with teacher preparation faculty in higher education
- Use OPI as a clearing house for best practices and resources, need to be vetted
- Need access to places for hands-on practice of science
- Field experiences are essential for all students
- Teachers need to be able to observe demonstrations of best teaching practices
- Integrate disciplines within science, and with literacy and math
- Prefer “resources” to referring to “textbooks” when talking about instructional materials
- Need technology and broadband access to support online resources and learning outside of school

Marissa Spang joined the meeting digitally, and provided the following suggestions with regard to support for schools going forward:

- A connection between research and practice when it comes to STEM learning.
 - Partnerships with Montana University Systems would help organize this work. There is currently a NSF research grant that looks at life centers learning in formal and informal environments at Montana State University that could support learning around the Next Generation Science Standards to help create professional learning around STEM.
 - Utilize the website www.stemteachingtools.org because it provides briefs on STEM learning in K-12 schools that is geared to district and school leaders and teachers. The briefs are synthesized around topics such as equity and make recommendations for all partners involved in learning.
- Localized fieldwork in one’s community as much as possible. Important to diversify student learning so students do not become monolithic in their orientation to the world by building relationships in their communities with individuals that would come in the classroom on a regular basis.
- Partnerships with informal learning organizations that support cross-cutting learning to make it relevant to their experiences outside K-12 learning.

Following the small group work, the committee participated in a larger discussion about whether or not there would be substantial costs for districts in implementing these standards.

- Gerry shared his thoughts that the basic needs identified in the previous activity are things that schools need every day of the week, regardless of the proposed science standards. When taking costs to the legislature, that point needs to be made. Beth Schule agreed that the basic just represents what schools need to do science well to give students what they deserve, no matter if the standards are adopted.
- Chris provided information from the perspective of the Great Falls Public Schools (GFPS) specific to each area identified in the survey:
 - Curriculum & development is already a priority and budgeted for in GFPS, so will not be an increase.
 - With regard to personnel, GFPS is in a good position, especially with regard to licensure. The new standards will not have major impact here.
 - Professional learning is a little more complicated because of contractual considerations at GFPS. Contracts only allow the school to identify what 6 of 18 hours of PIR for a teacher will be, so the district would like to pay staff for an additional day to go above and beyond which would have a fiscal impact. However, that added day would be the optimal scenario, and will not likely happen.

- Any impact in materials will likely be in the area of elementary. However, if implementation is not a hard and fast date of July 1, 2017 then the school will provide and replace materials on the schedule already built in without impact (based on what is already budgeted).
- Scott Dubbs of Lewistown Public Schools noted that he doesn't expect fiscal impact for his schools, sees more of an issue with making the connections with staff - providing the leadership that it will take to get the teachers where they need to be at. Using MPRES will become important for Lewistown.

It was then asked if the implementation date of July 1, 2017 is the date schools are expected to begin implementing, or if that is the date the new standards need to be fully implemented.

Madalyn Quinlan noted that she was not aware of anywhere of anywhere that stated that they needed to be fully implemented by that time. She went on to say that if the committee is acknowledging that it will take more than two years, it would be appropriate for the Board of Public Education to have a discussion about it. Pete Donovan agreed that conversation would be important for the Board to have to articulate the expectation to schools.

Jael Prezeau shared her thoughts that the implementation date is the date that schools are aware of the new standards and working on changes.

Lorie Carey anticipated that the biggest stumbling block for Boulder Public Schools and others will not be fiscal, but unwillingness to change.

The next steps in the science standards revision process were then shared with the committee:

- The EIS will be completed and submitted by May 23rd to the Interim Education and local Government Committee, which meets on June 23-24.
- On May 12, the Board of Public Ed will see a proposed timeline for adoption.
- The notice for adoption for public hearing will happen during the July 14-15 Board of Public Education meeting.
- The public hearing process will happen on or after August 26.
- There is a final written input deadline of September 3.
- Adoption is expected to happen at the September 15-16 meeting.
- Adoption Notice is published in the Montana Administrator Register in the beginning of October
- Implementation in July of 2017.

When the dates shared above are formalized by the Board of Public Ed, they will be added to the committee's website.

Public Comment

Public comment was provided by community member, parent and business person, Jim Fryer of Hobson, MT. Jim notified the committee he would make several comments regarding the proposed science standards, generally noting that the process seems rushed. He went on to indicate that he had hoped to see the committee have a more of a discussion on the standards. He shared that a few standards seem unrealistic at grade level and made him question exactly how they would be implemented in the classroom.

Before addressing the standards topics, Jim shared his commitment to science and raising his children as “scientists”. He explained that with today’s technology, there is no reason kids can’t be world leaders.

Jim made the following points with regard to the proposed science standards:

- The earth and space science kindergarten standard that states that students will “Communicate ideas about the impact of humans [on the land, water, air, or other living things in the local environment]” that will affect the impact of humans,” implies that students do have the solution. Do kindergarteners have solutions to this? And if not, why are they expected to communicate something they do not know?
- The physical science standard in second grade asks students to “make observations to construct an evidence-based claim of how an object [made of a small set of pieces can be disassembled and made into a new object]”. Why not have students disassemble and reassemble objects because explaining does not engage students enough in learning.
- Standards that refer to “materials” could pose difficulty in terms of the teacher’s ability to find and bring all the materials into the classroom that are needed.
- Reference to “primary sources” is vague and appears to need some definition in the document. The Next Generation Science Standards for instance, state that the media is a primary source. The media does not seem like a viable primary source – Montana’s science standards should teach good scientific reasoning instead.
- The life science standards that deal with plant growth do not seem to connect across the grades. A second grade standard talks about sunlight and water, then a fifth grade standard refers to air and water as essential to growth, and a high school standard refers to macromolecules, with no obvious connections between.
- Standards that deal with evaluating design concepts based on cost benefit ratios need to include opportunity cost and indirect cost. If you mention one, include all. Some things are better left a little bit general.
- The revision process means that new textbooks will be adopted, but the question is how do these standards fit with textbooks today and those published in the future? Do they match the common progression between grades and what other states are doing? There are a lot of pieces that have been done by other states that Montana can learn from.
- Assessment is also a consideration. Need to think about how we will know students are meeting these standards.
- Partnerships with the community are a good idea, but it is important to screen partnerships. Schools need to make sure these experts meet expectations.

Jim closed his comments by expressing his hope that he can still be engaged in the process, thanking the committee for its time and encouraging anyone to contact him with any questions. jfryer@bosterra.com.

Closing Remarks and Adjournment

The committee was thanked for its time, support and thoughtful consideration of the science standards.

The meeting was adjourned at 3:10

Submitted by:

Tara Steinke, 5/10/2016