From:	1490Comments
To:	1490Comments
Subject:	FW: Feedback on the Proposed MLS
Date:	Wednesday, December 09, 2015 1:02:45 PM
Attachments:	EnglishLanguageArts-FeedbackonProposedMLS.pdf ATT00001.htm Mathematics-FeedbackonProposedMLS.pdf ATT00002.htm Science-FeedbackonProposedMLS.pdf ATT00003.htm SocialStudies-FeedbackonProposedMLS.pdf ATT00004.htm

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From: Fowler, Amy [mailto:FowlerA@OSAGESCHOOLS.ORG]
Sent: Wednesday, December 02, 2015 4:59 PM
To: 1490Comments
Cc: Nelson, Laura
Subject: Feedback on the Proposed MLS

I have attached the feedback from the teachers of my school district. I appreciate all of the time that has been put in by all four work groups. Please let me know if you have any questions or concerns.

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English Language Arts
Feedback on Proposed MLS

Please use the following scale to provide feedback & provide any suggested revisions for standards:

1	2	3	4
Standards are acceptable as is. Overall the standards are listed at the appropriate grade level.	**Standards are acceptable, edits would improve, but are not mandatory. Very few (minor) issues.**	**Standards are acceptable *after* they are revised as suggested immediately below.**	**Standards require complete rewrite. Majority of standards are at *inappropriate* grade levels**

English Language Arts K-5									
Strand	**GRADE**	**1. The standards in this strand are developmentally appropriate.**	**2. The standards in this strand follow a coherent path through and across all grade levels.**	**3. The standards set a rigorous path of high expectations for students at each grade level.**	**4. The majority of the standards in this strand can be assessed in the classroom and/or on a state assessment.**	**5. The standards in this strand are understandable to educators and explainable to parents and other stakeholders.**	**6. The standards in this strand represent the necessary content for a student to reach college and/or career readiness upon graduation.**	**7. The standards in this strand are accurate and encompass the breadth of the content.**	**Overall comments regarding the proposed standards:**
Reading Foundations	K - 2	1	1	3	1	1	1	1	RF1Aa Kdg Should read recognize and name rather than identifying.
		1	1	3	1	1	1	1	RF1Ac Kdg Should read follow words from left to right not understand.
		1	1	3	1	1	1	1	RF1Aa 1st Should read recognize and name not

									identify.
		3	1	1	1	1	1	1	RF1Ad 1st move this standard to kdg.
		3	1	1	1	1	1	1	RF1Ae 1st and Kdg not just 1st
		3	1	1	1	1	1	1	RF1Ag 1st move to Kdg not 1st
		1	1	1	1	3	1	1	RF2Ae Kdg should read CVC words not simple words
		1	3	1	1	1	1	1	RF2Af,g,h should be reorganized. Put g first, then h, then f
		1	1	1	1	3	1	1	RF2Ag 1st should read medial vowel.
		1	3	1	1	3	1	1	RF3Ac Kdg provide dolch word list of 50 words
		1	3	1	1	3	1	1	RF3Am 1st provide dolch words list of 220 words
		4	4	4	4	4	4	4	RF3An 1st need to list reading strategies. Look at the picture. Reread. Read around and go back, Try both vowel sounds...
		1	1	1	1	3	1	1	RF3Ai 2nd What is grade

									appropriate?
		4	4	4	4	4	4	4	RF4A 1st and 2nd Provide a list of reading strategies
	3 - 5	3	4	3	2	2	2	1	RF3A 3rd-5th add a list of grade appropriate high frequency words, not coherent in the skills, the skills are in isolation and do not build upon each other
Reading	K - 2	3	3	3	1	1	1	1	R1A Kdg should include RI.K.6 from current MLS Need an awareness of author and illustrator (define and identify)
		3	3	3	1	1	1	1	R1B 1st should include L.1.4 c from current MLS
		3	3	3	1	1	1	1	R2C 1st a. needs to be moved to kindergarten
	3 - 5	4	4	4	1	2	4	4	R1A 3rd- e. Keep R1C-Take out, does not need whole standard, put connections with comprehension strategies,

									R1D4-5th- Needs clarification on rigor expected at each grade level. How do teachers go deeper each year? R2A3rd-d.say summarize, not paraphrase, f. take out! R2A4th- d-h-Take ALL out, need to concentrate on comprehension at this level, let kids choose fiction and nonfiction books without tying into a specific topic or genre, keep wording from R.I 5.6, Take out R2B, Move R3Bc. to 2nd grade, R3B5thb. be more specific use RI5.6 explanation, R#Ca. 3rd- DOK level 1, change to identify and explain, R3Cb. More explanation needed for compare and

									contrast, R3Cc. add using textual evidence, R3C 4th-Use wording of RI4.1, b. take out, confusing, c. use wording from RI4.8, R3C 5th-add RI.5.1and RI 5.8, R4-Do not scaffold in a stair step approach to each grade level, Add RI3.5, RF3A 3rd-5th, add list of grade specific high frequency words per grade level.
Writing	K - 2	3	1	1	1	1	1	1	W1Aa 1st Include using graphic organizer.
	3 - 5	4	3	2	2	3	2	3	The research strand is not developmentally appropriate. Don't change the language and standards from the current standards.
Speaking & Listening	K - 2	3	2	2	3	1	1	1	SL1A Kdg Should still include continue a conversation through multiple exchanges.
		3	1	1	3	1	1	1	SL1A 1st should

									include b. & c. from current MLS
		3	1	1	3	1	1	1	SL1A 2nd Should include b. & c. from current MLS
		3	1	1	3	1	1	1	SL2A 1st & 2nd should include apply skill to TEXTS.
		3	1	1	3	1	1	1	SL3A Kdg & 1st & 2nd should include requesting clarification if something is not understood.
		3	1	1	3	1	1	1	SL4A Kdg add speak audibly and express thoughts, feelings, and ideas clearly.
	3 - 5	2	2	2	2	2	2	2	
Language	K - 2	3	3	3	3	1	1	1	L1A 2nd a. Need to include introduce cursive but not master
		3	3	3	3	3	1	1	L1B Kdg f. Need to include the list of appropriate sight words.
		3	3	3	3	3	1	1	L1B 1st e. Need to include the list of appropriate

									sight words.
		3	3	3	3	1	1	1	L1B 2nd d. & e. move to 1st grade
		3	3	3	3	3	1	1	L1B 2nd g. & i. define grade appropriate
		3	3	3	3	3	1	1	L1A 1st a. Need to include current MLS print ALL Upper & Lowercase letters
	3 - 5	4	3	3	1	2	4	3	L1Aa. 3rd-Take cursive out or move to second grade. L1A 5th-change to demonstrate and apply, L1B 3rd-d, c, j. move back to second grade L1B4th-a. commas in series and commas with yes and no, move to 3rd,

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English Language Arts 6-12									
Strand	**GRADE**	**1. The standards in this strand are developmentally appropriate.**	**2. The standards in this strand follow a coherent path through and across all grade levels.**	**3. The standards set a rigorous path of high expectations for students at each grade level.**	**4. The majority of the standards in this strand can be assessed in the classroom and/or on a state assessment.**	**5. The standards in this strand are understandable to educators and explainable to parents and other stakeholders.**	**6. The standards in this strand represent the necessary content for a student to reach college and/or career readiness upon graduation.**	**7. The standards in this strand are accurate and encompass the breadth of the content.**	**Overall comments regarding the proposed standards:**
Reading Literary Texts	OMS	1	3 - RL6 This does not seem to build on each other. RL 7 Word Choice in 7th grade to signify tone does correlate with 6th grade sound device to create meaning.	2	3 - RL 5 - this seems very difficult to assess the validity of this. More guidance is needed. RL11 How can this be assessed?	3 RL4.7 - distinct (this would need to be defined) RL3 - what are visual elements? RL6 Is this point of view or viewpoint?	1	1	Need a glossary of terms (not open for interpretation) including literary devices, point of view vs. viewpoint, cite
	OHS	1	1	1	1	1	1	1	Language seems to match ACT language better: example "synthesize"

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Reading Informational Texts	OMS	1	1	1	2	1	1	1	How would #11 be accessed? We need a glossary of terms and definitions.
	OHS	1	1	2 - The trend with testing nonfiction would seem to demand some additional rigor in this area	1	1	1	1	
Writing & Researching	OMS	2- Students don't grasp the basic grammar	1	2 - The rigor is weak in 6th grade if students do not have to look at compound and complex sentences. This will affect their writing.	1	1	1	1	
	OHS	2- Students don't grasp the basic grammar	1	2 - The rigor is weak in 6th grade if students do not have to look at compound and complex sentences. This will affect their writing.	1	1	1	1	
Speaking & Listening	OMS	1	1	1	1	1	1	1	Leveling of the multimedia is a plus. Skills are easy to understand and can be assessed.
	O	1	1	1	1	1	1	1	

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Mathematics
Feedback on Proposed MLS

Please use the following scale to provide feedback & provide any suggested revisions for standards:

1	2	3	4
Standards are acceptable as is. Overall the standards are listed at the appropriate grade level.	**Standards are acceptable, edits would improve, but are not mandatory. Very few (minor) issues.**	**Standards are acceptable *after* they are revised as suggested immediately below.**	**Standards require complete rewrite. Majority of standards are at *inappropriate* grade levels**

Mathematics K-5									
Strand	**GRADE**	**1. The standards in this strand are developmentally appropriate.**	**2. The standards in this strand follow a coherent path through and across all grade levels.**	**3. The standards set a rigorous path of high expectations for students at each grade level.**	**4. The majority of the standards in this strand can be assessed in the classroom and/or on a state assessment.**	**5. The standards in this strand are understandable to educators and explainable to parents and other stakeholders.**	**6. The standards in this strand represent the necessary content for a student to reach college and/or career readiness upon graduation.**	**7. The standards in this strand are accurate and encompass the breadth of the content.**	**Overall comments regarding the proposed standards:**
Number Sense (K-1)	K								
	1								
Number Sense & Operations in Base Ten	K								
	1								
	2	1	1	1	1	1	1	1	
	3	2	2	2	2	2	2	2	3.NBT.A.2-through 10,000 instead of 100,000 3.NBT.A.3-What is

									efficiency-clarify with specific problems and amount of time
	4	1	1	1	1	3	1	1	Questionable especially to parents
	5	1	1	1	3	1	1	1	The verbs used to assess are very broad and not specific to what the students will be asked to do on state assessments.
Number Sense & Operations in Fractions	K								
	1								
	2	1	1	1	1	1	1	1	
	3	1	1	1	1	3	1	1	3.NF.A.1-4-The verb "understand" is vague-How do you assess "understand"? We also would like to make sure that our fractions do not go over 1 on a number line.
	4	1	1	1	1	3	1	1	The language clarity is much improved for both teachers and parents.
	5	2	2	1	3	2	1	2	The verbs used to assess are very broad and

									not specific to what the students will be asked to do on state assessments.
Relationships & Algebraic Thinking	K								
	1								
	2	1	1	1	1	1	1	1	
	3	3	3	1	1	3	1	1	3.RA.A.1-The verb "interpret" is unclear. A more specific description would be helpful 3.RA.B.1-They are not developmentally ready for distributive property. 3.RA.D.1-possibly change to a two-step addition and subtraction and one-step multiplication and division (With us just learning multiplication at this level and the keywords that go with it, it would be nice to start with a smaller foundation of solving

									multiplication/division word problems)
	4	1	1	1	1	3	1	1	For parents, when examples are provided, parents will have a better understanding of the standard.
	5	1	1	1	3	1	1	1	The verbs used to assess are very broad and not specific to what the students will be asked to do on state assessments.
Geometry & Measurement	K								
	1								
	2	1	1	1	1	1	1	1	
	3	1	2	1	1	3	3	3	3.GM.A.1-2-Not a real life skill. Tiling an area is an unlikely strategy to use when finding area. Would like to see it piggyback off of our multiplication and just work on length times width. 3.GM.C.3-Take completely out for same reason

									as above. 3.GM.D.2-Clarify what the verb "understand" means There is no working with money that shows up in any standards. 2nd grade covers counting money/4th grade covers solving problems with money...but there is no work with money at our level. We would hate for them to lose this skill by not working with it.
	4	1	1	1	1	3	1	1	For parents, when examples are provided, parents will have a better understanding of the standard.
	5	1	1	1	3	1	1	1	The verbs used to assess are very broad and not specific to what the students will be asked to do on state assessments.
Data & Statistics	K								

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	1								
	2	1	1	1	1	1	1	1	
	3	1	1	1	1	1	1	1	Line plots are nice for interpreting, but creating a line plot is an unrealistic skill.
	4	1	1	1	1	3	1	1	Much improved
	5	1	1	1	3	1	1	1	The verbs used to assess are very broad and not specific to what the students will be asked to do on state assessments.

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1	2	3	4
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Mathematics 6-8								
Strand	**1. The standards in this strand are developmentally appropriate.**	**2. The standards in this strand follow a coherent path through and across all grade levels.**	**3. The standards set a rigorous path of high expectations for students at each grade level.**	**4. The majority of the standards in this strand can be assessed in the classroom and/or on a state assessment.**	**5. The standards in this strand are understandable to educators and explainable to parents and other stakeholders.**	**6. The standards in this strand represent the necessary content for a student to reach college and/or career readiness upon graduation.**	**7. The standards in this strand are accurate and encompass the breadth of the content.**	**Overall comments regarding the proposed standards:**
Ratios & Proportional Relationships (RP)	1	1	1	1	2 - It would be very helpful to have clear/specific examples integrated into the standards for clarification for teachers as well as parents and other stakeholders who may not understand or comprehend the standards as well as those in the field of	3 - Standards help a student be college ready, but do not take into account students who need to be career ready. Standards and curriculum beyond 8th grade math are not applicable to students who are choosing to enter careers right out of HS.	1	

					education.			
Number Sense & Operations (NS)	1	1	1	1	2 - It would be very helpful to have clear/specific examples integrated into the standards for clarification for teachers as well as parents and other stakeholders who may not understand or comprehend the standards as well as those in the field of education.	3 - Standards help a student be college ready, but do not take into account students who need to be career ready. Standards and curriculum beyond 8th grade math are not applicable to students who are choosing to enter careers right out of HS.	1	It was very helpful to have some examples written with the standards. We believe students are more developmentally ready to understand integers in grades 3-5 than fraction and decimals along with their operations. Fractions and decimals could be more easily implemented at the middle grade level while teaching ratios and proportional relationships. We propose delaying teaching fractions and decimals to the middle grades and replace with integers.
Expressions, Equations & Inequalities (EEI)	1	1	1	1	2 - It would be very helpful to have clear/specific examples integrated into the standards for clarification	3 - Standards help a student be college ready, but do not take into account students who need to be	1	It would be helpful to know what standards are the priority standards and what are the supporting standards, so

					for teachers as well as parents and other stakeholders who may not understand or comprehend the standards as well as those in the field of education.	career ready. Standards and curriculum beyond 8th grade math are not applicable to students who are choosing to enter careers right out of HS.		we would not have to look at two different documents. Having all the information in one document would create a more seamless understanding.
Geometry & Measurement (GM)	1	3 - Angles and angle relationships are taught heavily in 3rd and 4th grade, and are not addressed again until 7th grade. The students are not retaining the information because they are not seeing/reviewing the concepts consistently every year.	1	1	2 - It would be very helpful to have clear/specific examples integrated into the standards for clarification for teachers as well as parents and other stakeholders who may not understand or comprehend the standards as well as those in the field of education.	3 - Standards help a student be college ready, but do not take into account students who need to be career ready. Standards and curriculum beyond 8th grade math are not applicable to students who are choosing to enter careers right out of HS.	1	
Data Analysis, Statistics & Probability (DSP)	3 - 6th Grade students are not developmentally ready to understand much of what is taught in this strand at 6th grade. They can follow the methodical process to solve statistical	3 -The heart of statistics is covered in 6th grade. This is too much with all the other skills that need to be covered in 6th grade. Possible solution - teach statistics in	1	1	2 - It would be very helpful to have clear/specific examples integrated into the standards for clarification for teachers as well as parents and other stakeholders	3 - Standards help a student be college ready, but do not take into account students who need to be career ready. Standards and curriculum beyond 8th	1	

	questions and create box plots, but they do not understand the analysis and interpretation of what they are creating/doing.	both 6th and 7th grade, and probability in 8th grade.			who may not understand or comprehend the standards as well as those in the field of education.	grade math are not applicable to students who are choosing to enter careers right out of HS.		
Functions (F)	1	1	1	1	2 - It would be very helpful to have clear/specific examples integrated into the standards for clarification for teachers as well as parents and other stakeholders who may not understand or comprehend the standards as well as those in the field of education.	3 - Standards help a student be college ready, but do not take into account students who need to be career ready. Standards and curriculum beyond 8th grade math are not applicable to students who are choosing to enter careers right out of HS.	1	

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Mathematics 9-12								
Strand	**1. The standards in this strand are developmentally appropriate.**	**2. The standards in this strand follow a coherent path through and across all grade levels.**	**3. The standards set a rigorous path of high expectations for students at each grade level.**	**4. The majority of the standards in this strand can be assessed in the classroom and/or on a state assessment.**	**5. The standards in this strand are understandable to educators and explainable to parents and other stakeholders.**	**6. The standards in this strand represent the necessary content for a student to reach college and/or career readiness upon graduation.**	**7. The standards in this strand are accurate and encompass the breadth of the content.**	**Overall comments regarding the proposed standards:**
Algebra								
Functions								
Data								
Geometry								

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Science
Feedback on Proposed MLS

Please use the following scale to provide feedback & provide any suggested revisions for standards:

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Science K-5									
Strand	**GRADE**	**1. The standards in this strand are developmentally appropriate.**	**2. The standards in this strand follow a coherent path through and across all grade levels.**	**3. The standards set a rigorous path of high expectations for students at each grade level.**	**4. The majority of the standards in this strand can be assessed in the classroom and/or on a state assessment.**	**5. The standards in this strand are understandable to educators and explainable to parents and other stakeholders.**	**6. The standards in this strand represent the necessary content for a student to reach college and/or career readiness upon graduation.**	**7. The standards in this strand are accurate and encompass the breadth of the content.**	**Overall comments regarding the proposed standards:**
Matter & Its Interactions (PS1)	K-1	1	1	1	1	2 - perhaps define"illustrate" in 1st grade objective, or use a different word	1	1	
	2	1	1	1 - conduct an investigation, analyze data	1	2 - maybe add an example to PS1-A for 2nd grade	1	1	took a lot of standards and compiled them into 1 broader standard
	3	1	4	1	1	1	1	3	Use current standards. Not covered in other grade levels.

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	4	1	1	1	1	1	1	1	
	5	2	2	2	3	4		3	What exactly is the expectation of a model?
Motion & Stability; Forces & Interactions (PS2)	K - 1	1	1	1	1	1	1	1	
	2	1	2 - no standard on magnetism until 3rd grade, used to be a big standard in 2nd grade	1	1	2 - again took a lot of standards and compiled them into 1 broader standard without examples	1	1	Only thing I see in 2nd grade that has to do with magnets is sorting...
	3	1	2	1	1	1	1	1	
	4	1	1	1	1	1	1	1	
	5	2	2	3	3	3		3 - Very simple	What exactly is the expectation of an argument?
Energy (PS3)	K - 1	N/A							
	2								
	3								
	4	3	4 - Where are the units-there are just fragments of units scattered throughout	1	2	2	1	1	
	5	2	2	PS3-B not rigorous PS3C is rigorous	3	3		3	What are the expectations of a model? Are formulas required?
Waves & Applications	K -	1	3 - PS4-A is the same objective	1	3 - include examples of how	1	1	1	

in Technology for Information Transfers (PS4)	1		in kindergarten and 1st grade		to assess this strand				
	2	1	1	1	1	2 - add examples??	1	1	same as before - lots of specific standard combined into 1 broader standard
	3								
	4	4	4	2	2	2	2	2	
	5	3	3	3	3	3		3	What exactly is the expectation of a model? Very vague!
From Molecules to Organisms: Structure & Process (LS1)	K - 1	4 - 1st grade's objectives are very difficult to understand which makes all of these areas difficult to judge	4	4	4	4	4	4	
	2	1	1	1	1	1	1	1	no change
	3	1	4	2	1	2	1	2	Not covered in other grades. Needs to be more specific for types of animals being compared.
	4	4	4	1	3	2	2	1	
	5	2	4 - Vertebrate/Invertebrate?????	1	3	2		2	Needs to say skeletal. What is the expectation for an argument!
Ecosystems: Interactions, Energy, & Dynamics (LS2)	K - 1								
	2	1	1	1	1	1	1	1	only change is the addition of

									dispersing seeds or pollinating plants
	3								
	4								
	5	2	2	2	2	3		2	What is the expectation of a model?
Heredity & Inheritance: Variation of Traits (LS3)	K - 1	2	3 - too big of a gap between 1st grade and 3rd grade. Not addressed in 2nd.	1	1	3 - please add examples to the 3rd grade students	1	1	
	2								
	3	4	3	1	3	3	2	3	Need clarification of standard
	4								
	5								
Biological Evolution: Unity & Diversity (LS4)	K - 1								
	2								
	3	4	3	1	3	3	2	3	Not covered in other grades. Argument, mates, and making a claim on merit is not appropriate for third grade and should be moved to a higher grade.
	4								
	5								Descriptors are

									needed for expectations. Unified vocabulary of terms and their meanings. Where is the engineering and technology? Unwrapping the standard will not be consist through grade levels in district and out of the district.
Earth's Place in the Universe (ESS1)	K - 1	1	1	1	1	1	1	1	
	2	1	1	1	1	2 - explain "Earth events"	1	1	like this wording much better
	3	1	1	1	1	1	1	1	
	4	4	1	1	1	1	1	1	
	5	3	3	3	3	3		3	Argument and what is expected of a graphical display?
Earth's Systems (ESS2)	K - 1	1	1	1	1	1	1	1	
	2	1	1	1	1	1	1	1	added standards dealing with preventing erosion and where water can be found on Earth
	3	1	1	3	1	1	1	1	Move to a lower grade.

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	4	4	3	1	4 - only through observation	1	1	1	
	5	1	1	1	1	1		1	
Earth & Human Activity (ESS3)	K - 1								This is only addressed in kindergarten. It may be problematic for the sustainability of our environment to not have this addressed again.
	2								removed how humans use rocks and soil
	3								
	4	1	1	1	1	1	1	1	
	5	3	3	3	3	3			What does the term science ideas mean?

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Science 6-8								
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Matter & Its Interactions (MS-PS1)	1	1	1	1	1	1	1	
Motion & Stability; Forces & Interactions (MS-PS2)	1	1	1	1	1	1	1	
Energy (MS-PS3)	1	1	1	1	1	1	1	
Waves & Applications in Technology for Information Transfers	1	1	1	1	1	1	1	

(MS-PS4)								
From Molecules to Organisms: Structure & Process (MS-LS1)	1	1	1	1	1	1	1	
Ecosystems: Interactions, Energy, & Dynamics (MS-LS2)	1	1	1	1	1	1	1	
Heredity & Inheritance: Variation of Traits (MS-LS3)	1	1	1	1	1	1	1	
Biological Evolution: Unity & Diversity (MS-LS4)	1	1	1	1	1	1	1	
Earth's Place in the Universe (MS-ESS1)	1	1	1	1	1	1	1	
Earth's Systems (MS-ESS2)	1	1	1	1	1	1	1	
Earth & Human Activity (MS-ESS3)	1	1	1	1	1	1	1	

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Please use the following scale to provide feedback & provide any suggested revisions for standards:

1	2	3	4
Standards are acceptable as is. Overall the standards are listed at the appropriate grade level.	**Standards are acceptable, edits would improve, but are not mandatory. Very few (minor) issues.**	**Standards are acceptable *after* they are revised as suggested immediately below.**	**Standards require complete rewrite. Majority of standards are at *inappropriate* grade levels**

Science 9-12								
Strand	**1. The standards in this strand are developmentally appropriate.**	**2. The standards in this strand follow a coherent path through and across all grade levels.**	**3. The standards set a rigorous path of high expectations for students at each grade level.**	**4. The majority of the standards in this strand can be assessed in the classroom and/or on a state assessment.**	**5. The standards in this strand are understandable to educators and explainable to parents and other stakeholders.**	**6. The standards in this strand represent the necessary content for a student to reach college and/or career readiness upon graduation.**	**7. The standards in this strand are accurate and encompass the breadth of the content.**	**Overall comments regarding the proposed standards:**
Matter & Its Interactions (HS-PS1)	2 - see overall comments	1	1	1	1	1	1	HS PS1-4: too high of a level for physical science
Motion & Stability; Forces & Interactions (HS-PS2)	1	1	1	1	1	1	1	Will students be able to use calculators on the state assessment?
Energy (HS-PS3)	1	1	1	1	3	1	1	HS PS3-1: do not understand what students are suppose to know
Waves & Applications in Technology	1	1	1	1	1	1	1	

for Information Transfers (HS-PS4)								
From Molecules to Organisms: Structure & Process (HS-LS1)	1 - We feel that teaching cellular organelles in the MS is not developmentally appropriate. An introduction to this suitable but mastery is not developmentally appropriate in the MS.	3 - there are gaps in content between MS and HS	1	1	3 - HS-LS2 is not clear	1	1	HS-LS1 covers content that will need reinforcement by high school teachers (specifically with cellular organelles and cell transport)
Ecosystems: Interactions, Energy, & Dynamics (HS-LS2)	1	1	1	1	1	1	1	Translation is good
Heredity & Inheritance: Variation of Traits (HS-LS3)	1	1	1	1	1	1	1	Translation is good
Biological Evolution: Unity & Diversity (HS-LS4)	1	1	1	1	1	1	1	Translation is good
Earth's Place in the Universe (HS-ESS1)								
Earth's Systems (HS-ESS2)								
Earth &								

Human Activity (HS-ESS3)								

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Social Studies
Feedback on Proposed MLS

Please use the following scale to provide feedback & provide any suggested revisions for standards:

1	2	3	4
Standards are acceptable as is. Overall the standards are listed at the appropriate grade level.	**Standards are acceptable, edits would improve, but are not mandatory. Very few (minor) issues.**	**Standards are acceptable *after* they are revised as suggested immediately below.**	**Standards require complete rewrite. Majority of standards are at *inappropriate* grade levels**

Social Studies K-5									
Strand	**GRADE**	**1. The standards in this strand are developmentally appropriate.**	**2. The standards in this strand follow a coherent path through and across all grade levels.**	**3. The standards set a rigorous path of high expectations for students at each grade level.**	**4. The majority of the standards in this strand can be assessed in the classroom and/or on a state assessment.**	**5. The standards in this strand are understandable to educators and explainable to parents and other stakeholders.**	**6. The standards in this strand represent the necessary content for a student to reach college and/or career readiness upon graduation.**	**7. The standards in this strand are accurate and encompass the breadth of the content.**	**Overall comments regarding the proposed standards:**
Document Shaping Constitutional Democracy	K - 2								
	3	4 - Seems VERY abstract when getting into state-level government	4 - Does build sequentially but not developmentally. 3rd grade was to be state focused but when comparing/contrasting to the national	4 - because of the abstract nature, this seem too rigorous	4 - This is not project based, rather constructed response.	4 - Too general/broad, not sure which areas of the topic to cover from one grade level to the next	4 - Does seem to be rigorous but, again, very deep for the third grade level	According to whom or what?	The number of standards needed to be covered have been overwhelmingly increased

			level it is necessary to teach both in order to truly have the understanding for comparing/contrasting.						
	4	4	4	4 - outside the realm of their cognitive understanding.	1	3 - too complex for parents and stakeholders	1	4 - these concepts go way too deep. (ie. inalienable rights, redress of grievances)	
	5	2	2	2	3	3	2	2	Some of these seem like they might be hard to assess. I am also concerned that some standards are a bit vague or broad for parents
Governance Systems	K-2								
	3	4	4	4 - too rigorous	4	4 - GS.2.D.3 can be understood. The others are very difficult to comprehend.	4	?	
	4	4	4	4 - outside the realm of their cognitive understanding	4 - cannot assess	4 - standards are way too broad	3	3	
	5	2	2	2	3	3	2	2	Confused of analyzing peaceful

									resolution of disputes of courts. Also confused on what you mean by authoritative decisions.
History	K - 2								
	3	2	2	1	1	1	1		
	4	1	1	1	1	1	1	1	
	5	1	2	1	1	1	1	1	I like the history part of the standards. Easy to understand.
Economics	K - 2								
	3	4 - E.4.C.3.a down through E.4.D.3. These seem to be very abstract for 3rd graders.	2	4 - stated on number 1.	2	4 - due to the last few already mentioned. (tax generation, cost analysis benefit)	3		
	4	1	1	1	1	1	1	1	
	5	1	2	1	1	1	1	1	
Geographic Study	K - 2								
	3	2 - EG.5.C.3.b: Way too broad	3	2	4 - (EG.5.C.3.b)	2	2		
	4	4	4	4	1	4	4	4	The geography is too broad for a 4th grader.
	5	1	2	1	1	1	1	1	
People,	K								

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Groups, & Cultures	K-2								
	3	4 - Too broad and hits beyond Missouri history.	4	4	4	4 - This strand is overwhelming and emcompasses many ideas and makes it difficult to know how to go about teaching the concepts. Can't really pinpoint the important parts of the broad concepts to teach.	4		
	4	4	4 - standards do not follow a coherent path through 4th grade	2	4	4 - too difficult, standard do not make sense	4	3	
	5	1	2	1	1	1	1	1	
Tools of Social Science Inquiry	K-2								
	3	4 - TS.7.A.3.a-Primary vs Secondary sources are too abstract for third graders.	4	4	4	4 - (TS.7.A.3.a is too abstract)	4		
	4	4	4	2	4	4 - stakeholders will not understand standards	3	4	
	5	1	2	1	2	1	1	1	My only concern with the changes to the standards

									is not having the materials to teach it and time to teach it all. I love the time period and content, but worry about fitting it all in and finding necessary resources.

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Please use the following scale to provide feedback & provide any suggested revisions for standards:

1	2	3	4
Standards are acceptable as is. Overall the standards are listed at the appropriate grade level.	**Standards are acceptable, edits would improve, but are not mandatory. Very few (minor) issues.**	**Standards are acceptable *after* they are revised as suggested immediately below.**	**Standards require complete rewrite. Majority of standards are at *inappropriate* grade levels**

Social Studies 6-12									
Strand	**GRADE**	**1. The standards in this strand are developmentally appropriate.**	**2. The standards in this strand follow a coherent path through and across all grade levels.**	**3. The standards set a rigorous path of high expectations for students at each grade level.**	**4. The majority of the standards in this strand can be assessed in the classroom and/or on a state assessment.**	**5. The standards in this strand are understandable to educators and explainable to parents and other stakeholders.**	**6. The standards in this strand represent the necessary content for a student to reach college and/or career readiness upon graduation.**	**7. The standards in this strand are accurate and encompass the breadth of the content.**	**Overall comments regarding the proposed standards:**
History: Continuity & Change	OMS	1	1	1	1	2 - could be more specific and measurable	1	1	At times, wording is nonspecific
	OHS	1	1	1	1	2 - Clarification may be need to explain these standards to stakeholders.	1	1	
Government Systems & Principles	OMS	1	1	1	2 - concern that some of the objectives are broad-how will new teachers know the specifics for testing; or the consistency of	2 - could be more specific and measurable	1	1	

					teachers across the board				
	OHS	2-Except T3S2B Standard B which requires mastery of both Articles of Confederation and the Constitution in order to compare to ideals present in the Declaration of Independence. This could be done at a basic level with some sophomores and a more advanced level with others.	1	1	1	1	1	1	
Geographical Study	OMS	1	1	1	2 - again some non-specific language for the US History	2 - language non-specific	1	1	
	OHS	1	1	1	1	1	1	1	These standards are most applicable in chapters that examine voting practices and representation (apportionment, gerrymandering)
Economic Concepts	OMS	1	1	1	1	1	1	1	
	OHS	1	1	1	1	3	1	1	More clarification is needed on standard T1S4A in order to

									properly teach content. Does this strand refer to opportunity cost in campaign finance, the federal budget, local budgets, interest group treasuries?
People, Groups, & Cultures	OMS	1	1	1	1	1	1	1	
	OHS	1	1	1	1	1	1		

From:	1490Comments
To:	1490Comments
Subject:	FW: Comments from Knox County High School Teachers
Date:	Wednesday, December 09, 2015 12:59:08 PM
Attachments:	Comments on HB1490 workgroups.docx

From: Brown, Brian [mailto:brian.brown@knoxr1.us]
Sent: Wednesday, December 02, 2015 2:32 PM
To: 1490Comments
Subject: Comments from Knox County High School Teachers

Please see attached document.

Thank you.

--
Brian Brown
Principal
Knox County R-1 High School

Comments on HB1490:
1. I think the variety of individuals to serve on the work groups will allow for a diverse range of opinion and viewpoints which will allow for the standards to be well-rounded.

2. Not necessarily a comment about the house bill or standards, but I think it would be beneficial to attend the public hearings about the revisions of the standards - would be a good PD opportunity and chance for continued ed.

3. As a vocational instructor that does not have a set standard represented in this HB and accompanying documents, I appreciate that the standards are broken into subsets that are easy for me to use to crosswalk with my current standards and curriculum. As I am writing new curriculum now it has made it fairly easy to transition some of the old into the new.

4. I do not see much difference in the standards that have been proposed and the pre-existing standards that will affect the choices I use for standards that fit in my curriculum, however in the data available to myself (crosswalks provided for certain courses through the DESE curriculum links) I have noticed they are vary subtle differences. For myself - this is handy and comforting while trying to re-write curriculum.

Proposed Standard -
RL.2.9-10 Determine the meaning of words and phrases as they are used in the text, including figurative and connotative meanings.

CCS-
RL.9- 10.4 Determine the meaning of words and phrases as they are used in the text, including figurative and connotative meanings; analyze the cumulative impact of specific word choices on meaning and tone (e.g., how the language evokes a sense of time and place; how it sets a formal or informal tone).

I feel if this standard is broadened to what the proposed standard states students will miss out on the analyzing portion of figurative and connotative language. They will miss out of important conversations needed to help students understand how words can be used in multiple ways and how these uses can impact a text.

Proposed Standard-
RL.11.9- 10 Analyze how multiple texts reflect the historical and/or cultural contexts.

RI.11.9- 10 Analyze how multiple texts reflect the historical and/or cultural contexts.

I like that they have added these standards in. I personally already teach multiple texts over several historical events, however, I could see how other teachers may not hit multiple texts without this standard. It is vital to look at different point of views over one event and have discussions over how these pov's affect the readers.

Proposed Standard-
RI.10.9- 10 Evaluate how effectively two or more texts develop similar ideas/topics.

Current Standard-
RI.9- 10.9 Analyze seminal U.S. documents of historical and literary significance (e.g., Washington’s Farewell Address, the Gettysburg Address, Roosevelt’s Four Freedoms speech, King’s “Letter from Birmingham Jail”), including how they address related themes and concepts.

I like how this standard has been broadened and allows the teacher to choose texts that our students can better relate too. I also like how the writing standards have been written. Several CCS standards have been combined, as well as the standard focusing on editing has been written with more detail.

---

1. I noticed that there appears to be a shift from memorization and rote learning to more hands-on and creative learning.

2. There are less standards here than were on the old CLE's.
3. It appears they have incorporated STEM components as well as interdisciplinary tie-ins.

---

1. I am glad to see that government has its own standards and that we are no longer lumped in together with Language Arts.

2. I like the fact that a citizen's personal responsibility is part of the standards.

3. I also like the fact that having political differences are worked into the standards.

Overall I view the new learning standards as being too vague in terms of the materials we are to cover in secondary Language Arts classes.

Many of the proposed reading standards seem to leave the content to be instructed up to the teacher, which could create an issue with uniformity in the curricula.

The proposed writing standard (WR.2.11-12) does not emphasize the techniques we should encourage students to develop, rather condensing the standard down to a short grab-bag of potential techniques to cover or blend.

---

1)I think they are similar to the NEXT Generation Science Standards
2) Alot of project based and creation of models
3) Requires more higher level thinking

The introductory statements for the themes are very informative and naturally break the standards into units unlike before where the standards would be used multiple times and have different meanings with each unit.

The possible sources of study that come with each theme is a great resource to find primary and secondary sources.

The proposed standards are the same as previous standards however the key concepts are much more detailed and easier to follow.

As I browsed the proposed standards, I did not find anything regarding the other courses that are offered which I believe play a big role in the education of students. In order for all to be "on the same page" I think it is crucial to also include elective classes like foreign language, P.E, art, etc.

From what I have seen, it looks like some of the previous standards are being simplified while others are getting added with so much information. That makes it confusing to understand what the actual expectation is.

Section 160.518. 2 states that " ….assessment system shall only permit the academic performance of students in each school in the state to be tracked against prior academic performance in the same school. How will that work for students that transfer late in the school year?

A1.NQ.A.1 - Language seems very specific as related to rational exponents and as compared to other domain standards. It is also a standard that is addressed in Algebra II. My concern is that these standards (A.1 and A.2) go beyond Algebra I.

A1.NQ.A.2 - Same as above.

Standards A1.CED.B.4 through B.7 - All contain concrete language that is readily understandable.

Overall, the new standards do a better job of defining the standards and adding specificity to their meanings. The CCS were, in general, more vague in their descriptions of the standard.

A2.SSE.D.14 - Appreciated the clearer language and specific expectations about logarithms

G.CP.B.7 - This standard lays out the expectation for understanding and applying the Addition Rule for probabilities. I feel like there should be a similar standard for the Multiplication Rule for probabilities, but it's sort of unclearly described in the conditional probability rules instead.

The geometry standards in general: "Theorems should include the following:" - does this mean those are the only theorems that should be included, or are there others and those are just examples?

From:	DESE Curriculum
To:	Boeckmann (DESE), Julie
Subject:	FW: Feedback for Storylines for Missouri K-5 Standards
Date:	Wednesday, December 02, 2015 12:51:14 PM
Attachments:	MO K_5 Science Storylines Feedback.docx

Standards Review comment for science.

From: David Bruns [mailto:David.Bruns@mdc.mo.gov]
Sent: Wednesday, December 02, 2015 11:26 AM
To: rbrazzle@jeffco.edu
Cc: DESE Curriculum; Bates, Shaun
Subject: Feedback for Storylines for Missouri K-5 Standards

Dr. Bob Brazzle,

I am emailing to provide feedback on the Storylines for Missouri K-5 Science Standards which I accessed through the DESE website. I have been contributing to the Proposed K-5 Science Standards Survey as well. My background includes an M.A. in Environmental Studies and Education and I have been teaching natural science (biology, ecology, geology, astronomy, physics) for a variety of organizations and institutions since 1986.

(I apologize for the quantity of text in this email. I have attached the text into a word document if this is easier for you.)

"Storylines" such as those seen in connection with the Next Generation Science Standards (NGSS), are useful as narratives of the science standards/expectations for each grade level. The current storylines for Missouri K-5 Science are much different than those used in the NGSS. I understand that one reason for this may be that the storylines for Missouri K-5 Standards are also intended as a "description of the underlying scientific principles" for teachers and parents (and I would include administrators).

I believe that there will be many changes to these draft standards prompted by the current review process and that this will in turn necessitate modifications to these storylines. My hope is that my feedback here will help validate changes you are already intending to make, and also share ideas that will help the final product to be a useful tool and well balanced between the major science strands of the new standards.

The challenge of writing storylines is to present what is to be covered at each grade level in a manner that is complete, concise and coherent. The current storylines content is selective of particular strands, sub strands and concepts. One of the primary concerns that I have with the current storylines is that while they emphasize the Earth Science and Physical Sciences, principles from the Life Sciences strand appear to be significantly underrepresented. This may result in unintended consequences discussed further below.

For example, in the K-5 Science Standards draft, Kindergarteners will be observing parts of plants and animals and identifying the needs of plants and animals to survive learning about what

organisms need to survive (sunlight, food, water, shelter, etc.). Learning experiences related to these standards are excellent opportunities for students to conduct, collaborative efforts applying authentic science practices and gaining insights that can begin to form foundations related to the engineering enterprise. The storylines currently omit this important section of their curriculum entirely.

The storylines for first grade present concepts from the Physical Science Strand related to force, motion and mass. There is no reference that students at this level are also to be studying structures of plants and animals and investigating how these structures function to help these organisms to survive. They will be learning about life cycles comparing and contrasting similarities and differences between parent and offspring. I believe that teachers and other would appreciate and benefit from having storylines related to these standards that will help them to present the concepts, terminology, etc. in a manner that is both developmentally appropriate and aligned with the target learning outcomes.

Second graders are to learn about how plants grow and certain interactions in which plants benefit. A Story line added for these standards can enable both the teachers and students to appreciate core principles and can also illustrate how particular science concepts, such as "Observable Properties", skills, such as "Compare contrast Classify" that are used in the physical sciences also apply along with crosscutting concepts, within the Life Sciences thus contributing an important quality of unity within science practices and pedagogy.

The 3rd grade level supporting standards in Life Science have the students develop an understanding of how structural adaptations help organisms to survive within particular environments. These important standards, concepts and performance expectations are not addressed in the current storylines.

In the 5th grade level, students will be learning about how plants use energy from the sun to combine ground water and atmospheric gases into matter that serves as food/energy for primary and secondary consumers which utilize that energy and then return the matter back into the ecosystem through the process of decomposition. This is a very significant set of concepts because this is when students essentially learn how nature (the biosphere) works (and interacts with the atmosphere, geosphere, hydrosphere, etc.). It is the foundation to understand the concept of competition needed to understand the negative impacts of invasive species. It is the foundation to begin to understand the causes of, and potentially solutions to the effects of global climate change. It is the foundation of human efforts to protect and manage natural systems on which we ourselves rely for our own survival. In respect to this, "The Big Idea" presented at the top of 5th Grade "Fundamental Unity among Organisms" seems incomplete.

Possible unintended consequences of an incomplete presentation of Life Science principles in these storylines include the implication that the Life Science standards are somehow less important than the Earth and Physical Sciences. There is an excellent article from the National Science Teachers Association on the importance of Life Science in relation to the NGSS (Bybee, Roger 2013). This can be seen here: http://nstahosted.org/pdfs/ngss/resources/201302_NGSS-Bybee.pdf

Another consequence is that it may promote a presumption that principles in Earth and Physical Sciences are more difficult to understand therefore possessing greater need for explanation and elaboration than principles related the Life Science standards. I assure you, from my own extensive experience training and working with teachers, that these teachers at the K-5 levels would appreciate and benefit from elaboration of Life Science principles just as much as from the other major strands.

For example, terms including Environments, Ecosystems and Habitats are used in the language of these standards, but how are these terms related? Are they essentially synonymous or are there important distinctions between these that the teachers and students should pay attention to? Even the term Adaptation can be confusing to both teachers and students at these grade levels. Probably they would benefit from distinguishing whether the term adaptation should be interpreted, in the noun sense, as a physical structure or behavior, or in the verb sense as it is often used to denote gradual change over time, (evolution), by analyzing the context in which the term is used. (The odd use of the term "Adaption" LS4C in the current standards draft –which I suspect is used as an alternative to the "E" word -adds to this confusion) Elaboration of these principles within the K-5 Missouri storylines can serve to clarify how these Life Science terms are to be used by the teacher to provide clear guidance to the students in relation to the intended curriculum standards at each grade level.

Here are some further feedback, observations, thoughts and suggestions for consideration:

As mentioned above, the Missouri K-5 storylines are very different than those presented as part of the NGSS which can be accessed at: http://www.nextgenscience.org/search-standards
The NGSS storylines are very succinct, 400-500 words each, and follow a particular format which is consistently used for each grade level. Since much of the Missouri K-5 Science Standards are modeled after, use, and make reference to, the NGSS, I recommend that the Missouri Storylines be modeled after the storylines from the NGSS as well, -acknowledging the intent to add more content that may be helpful for elaborative purposes.

This NGSS storyline format for each storyline starts with a list of essential/driving questions that are tied to the performance expectations for that grade level. I believe that this is important in the design since it essentially shifts educational emphasis from "Learning about" to "Figuring out" - engaging authentic science practices - a deliberate intended quality of the NGSS – and is contrast to simply presenting content which has been the common approach to teaching science in the past. It is these driving questions tied to anchoring phenomena that leads students to investigating and building knowledge through practices and constructing models that explain phenomena. (See Reiser, 2014):
http://www.academia.edu/6884962/Designing_Coherent_Storylines_Aligned_with_NGSS_for_the_K-12_Classroom
Whether or not you shift the format of the current storylines to better match those from the NGSS, I suggest that adding these driving questions to each storyline will be valuable to teachers towards effective teaching of science as intended within the design of the new Missouri Standards.

The NGSS storyline format then goes on to list the specific standards covered at each grade level; to

state the (Disciplinary) Core Ideas; to list the crosscutting concepts that are called out as organizing concepts, and then finally to list the performance expectations specific to each grade level. As I stated above, this results in storylines that are useful as complete, concise, coherent and consistent narratives of the science curriculum for each grade level.

In its current form, there are inconsistencies in how the storylines for the Missouri K-5 standards and expectations are presented at each respective grade level. For example, storylines for 4th grade occupy 17 pages of text, compare with 10 pages at the 5th grade and 7 pages at the 3rd grade. Each grade level storyline divided into sections; topical, and based generally on sub strands from the standards; and these biased towards the Earth and Physical sciences as noted above. All of these sections have "The Big Idea" subsection, but "Component Ideas" is only seen as a subsection heading at the 5th grade level. "Curriculum Connections" is only seen as a subsection heading at the 4th grade level, as is "A Note about Vocabulary" and "A Note about Instruction". The heading "An example of…" also seen only in the 4th grade story line, precedes text that looks a lot like a lesson plan.

The last sections of the document contain "K-5 Storylines" (Space Sciences, The Engineering Design Process and the Nature of Scientific inquiry). These sections seem incongruous to the document as a whole and it is unclear how these can be labeled storylines in the same manner as the others. I recommend that salient concepts from these sections either become integrated into appropriate locations within each grade level, or that these sections become integrated either as part of a general introduction to the grade level storylines, or else as relevant appendices, but in either case not labeled as storylines.

In order to have greater consistency between how storylines are presented for each grade level, I recommend eliminating all non-essential sub section headings and unifying these headings so that each grade level follows a consistent format. Each storyline for each grade level should strive to occupy a relatively comparable/equitable amount of text.

One possible formatting option to presenting the storylines, which may help ameliorate some of the challenges discussed above, is recommended here:

- Each Missouri Grade Level Storyline can be divided into three main subsections: Physical Science, Life Science and Earth Science (In this order -as this is the order in which these strands are presented in the standards documents).
- Each of these subsections can include a "The Big Ideas" (Which combine and summarize the Core Ideas -appropriate to that grade level's science standards).
- Each section should also, for reasons stated above, present a set of essential/driving questions connected to specific performance expectations and modeled after the storylines from the NGSS.
- Each subsection can also include a "Component Ideas" section in which a "description of the underlying scientific principles" can be elaborated, utilizing text already developed, specific to that science strand for that grade level. While elaboration of these principles should strive to be succinct and developmentally appropriate, I believe that much of the current text can be significantly edited to elaborate briefly on essential information related to the core principles for each section.
- Reference to particular "crosscutting concepts" (patterns, cause and effect, structure and

function etc.) might also be addressed that demonstrate how these apply across the various domains of science (although I have been unable to find how this is explicitly addressed in the draftK-5 Proposed Science Standards).

I also recommend that the inclusion of "teaching tips" be avoided since this gets onto a slippery slope toward the document becoming a text heavy and unwieldy teaching manual outside of how the term "storyline" is used in the field of education to refer to a narrative of the standards and expectations.

On the final draft, I believe that essential information for each strand (ESS, LS, PS) subsection can be adequately presented on one page for each grade level such that the full storyline (including elaboration of principles) for each grade level can be presented on approximately 3-5 pages in a manner that is concise, coherent, consistent and unambiguously connected to the science standards documents.

My final comment for feedback in this email/document is that I noticed that the story lines are presented in reverse grade level order from 5th grade to kindergarten. I recommend that these be switched to grade level order, consistent with how the standards and performance expectations are presented through all of the documents. This will better facilitate the ability for administrators, educators, parents, etc. to see how the science curriculum progresses through levels of targeted learning and follow how these storylines align with the standards.

In conclusion, I want to acknowledge the obvious, significant effort already invested in producing this important document. Please let me know if you would like to correspond further regarding this feedback, thoughts and ideas I have presented here. Recognizing your strength is in the physical sciences, I am willing to help write, or at least help review, text related to the Life Science content of these storylines if this is helpful. As stated above, my intention is to serve the needs of teachers and their students with a useful tool that is well balanced between the major strands of the new K-5 Science Standards.

Respectfully submitted,

David J. Bruns
Conservation Education Consultant
Missouri Department of Conservation
11715 Cragwold Rd.
Kirkwood, MO, 63122
(314) 301-1506 ext. 4212
david.bruns@mdc.mo.gov

Feedback and Recommendations for the Missouri K-5 "Storylines"

December 1, 2015

Dr. Bob Brazzle,

This document provides feedback on the Storylines for Missouri K-5 Science Standards which I accessed through the DESE website. I have been contributing to the Proposed K-5 Science Standards Survey as well. My background includes an M.A. in Environmental Studies and Education and I have been teaching natural science (biology, ecology, geology, astronomy, physics) for a variety of organizations and institutions since 1986.

"Storylines" such as those seen in connection with the Next Generation Science Standards (NGSS) are useful as narratives of the science standards/expectations for each grade level. The current storylines for Missouri K-5 Science are much different than those used in the NGSS. I understand that one reason for this may be that the storylines for Missouri K-5 Standards are also intended as a "description of the underlying scientific principles" for teachers and parents (and I would include administrators).

I believe that there will be many changes to these draft standards prompted by the current review process and that this will in turn necessitate modifications to these storylines. My hope is that my feedback here will help validate changes you are already intending to make, and also share recommendations that will help the final product to be a useful tool and well balanced between the major science strands of the new standards.

The challenge of writing storylines is to present what is to be covered at each grade level in a manner that is complete, concise and coherent. The current storylines content is selective of particular strands, sub strands and concepts. One of the primary concerns that I have with the current storylines is that while they emphasize the Earth Science and Physical Sciences, principles from the Life Sciences strand appear to be significantly underrepresented. This may result in unintended consequences discussed below.

For example, in the K-5 Science Standards draft, Kindergarteners will be observing parts of plants and animals and identifying the needs of plants and animals to survive learning about what organisms need to survive (sunlight, food, water, shelter, etc.). Learning experiences related to these standards are excellent opportunities for students to conduct, collaborative efforts applying authentic science practices and gaining insights that can begin to form foundations related to the engineering enterprise. The storylines currently omit this important section of their curriculum entirely.

The storylines for first grade present concepts from the Physical Science Strand related to force, motion and mass. There is no reference that students at this level are also to be studying structures of plants and animals and investigating how these structures function to help these organisms to survive. They will be learning about life cycles comparing and contrasting similarities and differences between parent

and offspring. I believe that teachers and other would appreciate and benefit from having storylines related to these standards that will help them to present the concepts, terminology, etc. in a manner that is both developmentally appropriate and aligned with the target learning outcomes.

Second graders are to learn about how plants grow and certain interactions in which plants benefit. A Story line added for these standards can enable both the teachers and students to appreciate core principles and can also illustrate how particular science concepts, such as "Observable Properties", skills, such as "Compare contrast Classify" that are used in the physical sciences also apply along with crosscutting concepts, within the Life Sciences thus contributing an important quality of unity within science practices and pedagogy.

The 3rd grade level supporting standards in Life Science have the students develop an understanding of how structural adaptations help organisms to survive within particular environments. These important standards, concepts and performance expectations are not addressed in the current storylines.

In the 5th grade level, students will be learning about how plants use energy from the sun to combine ground water and atmospheric gases into matter that serves as food/energy for primary and secondary consumers which utilize that energy and then return the matter back into the ecosystem through the process of decomposition. This is a very significant set of concepts because this is when students essentially learn how nature (the biosphere) works (and interacts with the atmosphere, geosphere, hydrosphere, etc.). It is the foundation to understand the concept of competition needed to understand the negative impacts of invasive species. It is the foundation to begin to understand the causes of, and potentially solutions to the effects of global climate change. It is the foundation of human efforts to protect and manage natural systems on which we ourselves rely for our own survival. In respect to this, "The Big Idea" presented at the top of 5th Grade "Fundamental Unity among Organisms" seems incomplete.

Possible unintended consequences of an incomplete presentation of Life Science principles in these storylines include the implication that the Life Science standards are somehow less important than the Earth and Physical Sciences. There is an excellent article from the National Science Teachers Association on the importance of Life Science in relation to the NGSS (Bybee, Roger 2013). This can be seen here: http://nstahosted.org/pdfs/ngss/resources/201302_NGSS-Bybee.pdf

Another consequence is that it may promote a presumption that principles in Earth and Physical Sciences are more difficult to understand therefore possessing greater need for explanation and elaboration than principles related the Life Science standards. I assure you, from my own extensive experience training and working with teachers, that teachers at the K-5 levels would appreciate and benefit from elaboration of Life Science principles just as much as from the other major strands.

For example, terms including Environments, Ecosystems and Habitats are used in the language of these standards, but how are these terms related? Are they essentially synonymous or are there important distinctions between these that the teachers and students should pay attention to? Even the term

Adaptation can be confusing to both teachers and students at these grade levels. Probably they would benefit from distinguishing whether the term adaptation should be interpreted, in the noun sense, as a physical structure or behavior, or in the verb sense as it is often used to denote gradual change over time, (evolution), by analyzing the context in which the term is used. (The odd use of the term "Adaption" LS4C in the current standards draft –which I suspect is used as an alternative to the "E" word -adds to this confusion) Elaboration of these principles within the K-5 Missouri storylines can serve to clarify how these Life Science terms are to be used by the teacher to provide clear guidance to the students in relation to the intended curriculum standards at each grade level.

Here are some further feedback, observations, thoughts and suggestions for consideration:

As mentioned above, the Missouri K-5 storylines are very different than those presented as part of the NGSS which can be accessed at: http://www.nextgenscience.org/search-standards
The NGSS storylines are very succinct, 400-500 words each, and follow a particular format which is consistently used for each grade level. Since much of the Missouri K-5 Science Standards are modeled after, use, and make reference to, the NGSS, I recommend that the Missouri Storylines be modeled after the storylines from the NGSS as well, -acknowledging the intent to add more content that may be helpful for elaborative purposes.

This NGSS storyline format for each storyline starts with a list of essential/driving questions that are tied to the performance expectations for that grade level. I believe that this is important in the design since it essentially shifts educational emphasis from "Learning about" to "Figuring out" -engaging authentic science practices - a deliberate intended quality of the NGSS – and is in contrast to simply presenting content which has been the common approach to teaching science in the past. It is these driving questions tied to anchoring phenomena that leads students to investigating and building knowledge through practices and constructing models that explain phenomena. (See Reiser, 2014): http://www.academia.edu/6884962/Designing_Coherent_Storylines_Aligned_with_NGSS_for_the_K-12_Classroom
Whether or not you shift the format of the current storylines to better match those from the NGSS, I suggest that adding these driving questions to each storyline will be valuable to teachers towards effective teaching of science as intended within the design of the new Missouri Standards.

The NGSS storyline format then goes on to list the specific standards covered at each grade level; to state the (Disciplinary) Core Ideas; to list the crosscutting concepts that are called out as organizing concepts, and then finally to list the performance expectations specific to each grade level. As I stated above, this results in storylines that are useful as complete, concise, coherent and consistent narratives of the science curriculum for each grade level.

In its current form, there are inconsistencies in how the storylines for the Missouri K-5 standards and expectations are presented at each respective grade level. For example, storylines for 4th grade occupy 17 pages of text, compare with 10 pages at the 5th grade and 7 pages at the 3rd grade. Each grade level storyline divided into sections; topical, and based generally on sub strands from the standards; and

these biased towards the Earth and Physical sciences as noted above. All of these sections have "The Big Idea" subsection, but "Component Ideas" is only seen as a subsection heading at the 5th grade level. "Curriculum Connections" is only seen as a subsection heading at the 4th grade level, as is "A Note about Vocabulary" and "A Note about Instruction". The heading "An example of…" also seen only in the 4th grade storyline, precedes text that looks a lot like a lesson plan.

The last sections of the document contain "K-5 Storylines" (Space Sciences, The Engineering Design Process and the Nature of Scientific inquiry). These sections seem incongruous to the document as a whole and it is unclear how these can be labeled storylines in the same manner as the others. I recommend that salient concepts from these sections either become integrated into appropriate locations within each grade level, or that these sections become integrated either as part of a general introduction to the grade level storylines, or else as relevant appendices, but in either case not labeled as storylines.

In order to have greater consistency between how storylines are presented for each grade level, I recommend eliminating all non-essential sub section headings and unifying these headings so that each grade level follows a consistent format. Each storyline for each grade level should strive to occupy a relatively comparable/equitable amount of text.

One possible formatting option to presenting the storylines, which may help ameliorate some of the challenges discussed above, is recommended here:

- Each Missouri Grade Level Storyline can be divided into three main subsections: Physical Science, Life Science and Earth Science (In this order -as this is the order in which these strands are presented in the standards documents).
- Each of these subsections can include a "The Big Ideas" (Which combine and summarize the Core Ideas -appropriate to that grade level's science standards).
- Each subsection should also, for reasons stated above, present a set of essential/driving questions connected to specific performance expectations and modeled after the storylines from the NGSS.
- Each section can also include a "Component Ideas" section in which a "description of the underlying scientific principles" can be elaborated, utilizing text already developed, specific to that science strand for that grade level. While elaboration of these principles should strive to be succinct and developmentally appropriate, I believe that much of the current text can be significantly edited to elaborate briefly on essential information related to the core principles for each section.
- Reference to particular "crosscutting concepts" (patterns, cause and effect, structure and function etc.) might also be addressed that demonstrate how these apply across the various domains of science (although I have been unable to find how this is explicitly addressed in the draftK-5 Proposed Science Standards).

I also recommend that the inclusion of “teaching tips” be avoided since this gets onto a slippery slope toward the document becoming a text heavy and unwieldy teaching manual outside of how the term “storyline” is used in the field of education to refer to a narrative of the standards and expectations.

On the final draft, I believe that essential information for each strand subsection (ESS, LS, PS) can be adequately presented on one page for each grade level such that the full storyline (including elaboration of principles) for each grade level can be presented on approximately 3-5 pages in a manner that is concise, coherent, consistent and unambiguously connected to the science standards documents.

My final comment for feedback in this email/document is that I noticed that the story lines are presented in reverse grade level order from 5th grade to kindergarten. I recommend that these be switched to grade level order, consistent with how the standards and performance expectations are presented through all of the documents. This will better facilitate the ability for administrators, educators, parents, etc. to see how the science curriculum progresses through levels of targeted learning and follow how these storylines align with the standards.

In conclusion, I want to acknowledge the obvious, significant effort already invested in producing this important document. Please let me know if you would like to correspond further regarding this feedback, thoughts and ideas I have presented here. Recognizing your strength is in the physical sciences, I am willing to help write, or at least help review, text related to the Life Science content of these storylines if this is helpful. As stated above, my intention is to serve the needs of teachers and their students with a useful tool that is well balanced between the major strands of the new K-5 Science Standards.

Respectfully submitted,

David J. Bruns
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From: Hallie Mills
To: 1490Comments
Subject: K-5 Science Standards
Date: Tuesday, December 01, 2015 9:34:54 PM

Hello,

My name is Hallie Mills and I recently moved to Missouri from Washington State. I am a veteran elementary teacher certified in both WA and MO, and I am passionate about science education!

I have been reviewing the proposed Science Standards for K-5 and I must admit I am disappointed by what I see. It appears that the working group did some picking and choosing with the Next Generation Science Standards. I don't see any mention of the Science and Engineering Practices or Crosscutting Concepts - two important strands of the Three Dimensions used in NGSS.

Washington State has adopted the Next Generation Science Standards, and last year I spent quite a bit of time diving in and doing some early work exploring NGSS. I admit, it took me some time to understand the Three Dimensions, and shift my mindset away from things like the scientific method and move to accepting Science and Engineering Practices. However, after my work last year I have really come to appreciate NGSS. As written, the new Missouri K-5 standards seem to be disjointed and the progression through the grades is not as smooth as it could be. In some areas the Missouri Standards are quite specific, and are not going as deep as the Framework and NGSS advocate for students to go.

The great thing, in my opinion, about NGSS is that the standards are really designed to give students authentic science and engineering work. Students are doing science, not just reading about it or memorizing vocabulary. They are forming their own opinions and learning to collaborate with others. Using NGSS was highly engaging for my students. The science and engineering practices specifically call for students to read and analyze science texts, to write their own opinions, and support their claims with evidence. All of these are direct connections to ELA standards. Science is a conduit for teaching reading and writing, it is highly engaging, and gives students natural motivation to learn more.

It is my understanding that the secondary science standards more closely align with NGSS. NGSS is designed to spiral throughout K-12. If K-5 science standards are left as is there will be gaps in their knowledge - both in content and in their science and engineering skills. Middle School and High School teachers are going to have to fill those gaps in order to even start where they want to start.

I encourage the board to revisit the K-5 science standards. Align the work more closely with the secondary standards, bring in all three dimensions of the Next Generation Science Standards, and raise the level of rigor for everyone. Your students will rise to the occasion and you will be amazed.

If you have any questions, or if I can help in this process in any other way, please let me know.

Hallie Mills
206-747-8625

From:	McDowell, Crystal
To:	1490Comments
Subject:	Feedback on Secondary Science Standards
Date:	Monday, November 30, 2015 12:05:10 PM
Attachments:	Feedback on MO Science Standards_Scanned Documents 1.pdf Feedback on MO Science Standards_Scanned Documents 2.pdf Feedback for Proposed HS Science MLS.pdf Feedback for Proposed MS Science MLS.pdf

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Missouri State Board of Education Members,

I am attaching collective feedback from a number of teachers and other educational leaders (Rockwood School District and other districts from the St. Louis region) regarding the proposed standards for secondary science.

I will mail in the hard copies but wanted to scan the documents and email them to ensure response by the Dec. 2 deadline.

We would have loved to have had more time to reach more people in terms of this method of feedback but wanted to share what we were able to accumulate and manage. I am confident I would have had other middle and high school teachers as well as other administrators to sign.

The scanned documents contain a letter, signed support pages, and feedback on both the proposed middle and high school science standards.

Thank you,

Crystal

Crystal McDowell
Secondary Science Coordinator
Rockwood School District | 500 North Central Ave., Eureka, MO 63025
(p) 636.733.2109 | (c) 636.438.8595 | (f) 636.938.2365
Twitter: @RSDSciRocks

"Science can be leveraged to meet students at their interest and in their own world. It allows them to make sense of the world around them even when experience or language is a barrier. *Science is a great equalizer.* It must be if we are to give every student an equal opportunity for adult success" (*NGSS for All Students, p. 3)*

ROCKWOOD SCHOOL DISTRICT

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Crystal McDowell
Science Coordinator (6-12)

November 2, 2015

To whom it may concern,

In the Foreword to *A Framework for K-12 Science Education*, the President of the National Academy of Sciences and the President of the National Academy of Engineering stated that "the impetus for [the *Framework*] grew from the recognition that, although the existing [documents] on science content for grades K-12 (developed in the early to mid-1990s) were an important step in strengthening science education, there is much room for improvement. Not only has science progressed, but . . . . there is a new and growing body of research on learning and teaching in science that can inform a revision of the standards and revitalize science education" (p. ix). Years of research have led to the development of this extensive report about how students develop science literacy and a deeper understanding of science. The three-dimensional model presented represents first best instruction in science.

As we conducted our K-12 science program evaluation, we arrived at a shared vision for what science instruction should provide students in Rockwood. We want to cultivate learning environments that promote problem solving and critical thinking. We want to engage students with authentic, real-world problems and applications. We aim to integrate more STEM opportunities for all students and we strive to equip students with the skills they need to be college, career, and citizenry ready as they graduate. As we developed that vision, we also compared our thoughts and goals to the *Framework*. What we discovered is that the *Framework*, resulting standards, and the model for three-dimensional instruction and learning through integration of the science and engineering practices, disciplinary core ideas, and crosscutting concepts collectively provide the tools for us to accomplish our vision. We are encouraged to see that the HB1490 Secondary Science Workgroup reached that same conclusion as the members consulted the research and this framework for science education. The proposed standards support the three-dimensional model as well as most of the learning progressions supported by this research.

Our analysis supports the majority of the proposed standards but we have also provided feedback. We appreciate this opportunity to offer feedback on the proposed standards. Our analysis stems from the collaborative effort of a number of curriculum coordinators in the Saint Louis area, teachers, and other educators who are all committed to what is best for Missouri students in terms of science education and their overall college, career, and citizenry readiness. Included are the names of individuals from our educational community who had the opportunity to review this analysis and wish to provide collective feedback on the proposed standards. Also included is the analysis and feedback.

Thank you,

Crystal McDowell

Crystal McDowell
Secondary Science Coordinator
Rockwood School District

Enclosures

My signature hereby signifies that I support this analysis and wish to provide feedback on the proposed Missouri Learning Standards for Secondary Science:

Crystal McDowell	Secondary Science Coordinator, RSD
Deborah Spreyer	RSMS 6th Grade Life Science Teacher, RSD
Daniel Salter	6th grade Life Science Teacher, RSD
Angela Fonda	6th LS RSD
MDGes	5 M S - LS
Dr. David Smith	8-Gold CMS
Natl	CMS-Principal
	Teacher-7th RVMS
	TEACHER RVMS 7TH
M. Zl	Science 6th WMS
K. Semple	Science 7th WMS
C. Holy	WMS
Karen Strength	LSMS - 8th
Krista Behlmann	RVMS 6th
	LSMS-8th
Mary Anne Moan	LSMS 6th

My signature hereby signifies that I support this analysis and wish to provide feedback on the proposed Missouri Learning Standards for Secondary Science:

[illegible]	RVMS - 8th
Cathy Farrar	MHS 9-12
Cami Hall	LHS 9-12
Shan Hancock	Dir Research, Evaluation + Assessment
Susanne K Moar	K-5 Science Facilitator
Lisa Lyle	Secondary Mathematic Facilitator
Shelley Willett	Director of Curriculum & Instruction
[illegible]	Coordinator of STEM
Robin Green	FHS - Science
Becky Litherland	Middle Level STEM Coordinator - Parkway
[illegible]	SLPS Science Curr Specialist
Christina Hughes	Hazelwood K-12 Science Coord.
[illegible]	Coordinator of K-5 Literacy
[illegible]	Director of Professional learning (previous chemistry teacher)
Karen Haragadine	Asst. Sup. Learning & Support Services Rockwood School District
Stephanie Nauman	Elem. Math Facilitator / Parent

My signature hereby signifies that I support this analysis and wish to provide feedback on the proposed Missouri Learning Standards for Secondary Science:

Mark Hanneke →	Mariah Hanneke (CMS)	7th Grade Science
Elizabeth Orf	Elizabeth Orf (CMS)	7th Grade Science
Jennifer Sinn	Jennifer Sinn (CMS)	7th Grade Science

My signature hereby signifies that I support this analysis and wish to provide feedback on the proposed Missouri Learning Standards for Secondary Science:

Keith Henige

Karen Betz

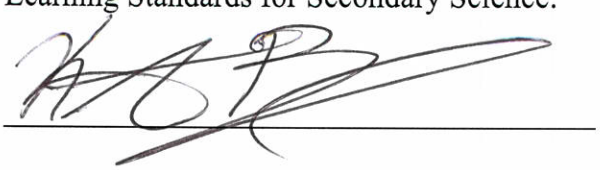
Stephen Polster

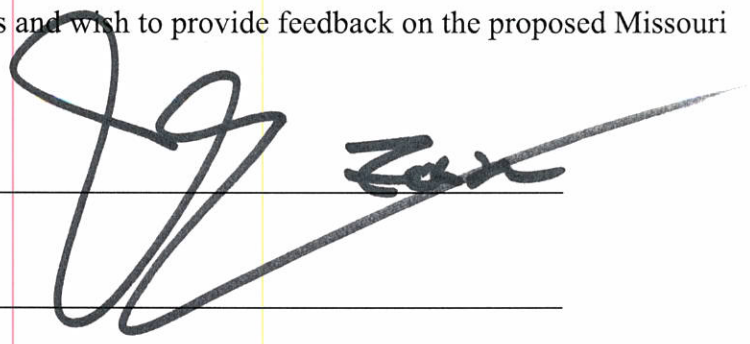
Keith Henige

Karen Betz

Stephen Polster

My signature hereby signifies that I support this analysis and wish to provide feedback on the proposed Missouri Learning Standards for Secondary Science:





My signature hereby signifies that I support this analysis and wish to provide feedback on the proposed Missouri Learning Standards for Secondary Science:

Janet L Foote — 6th & 7th Grade Science

Robert Hicks — 8th Grade Science

Feedback for Proposed MS MLS

Front Matter	Feedback
Overview, Page 1	● States the multiple sets of standards consulted to provide guidance and comparison for the new MLS (current MLS, NGSS, MA State Standards (2006, 2012), SC State Standards, and the MO Curriculum Alignment Initiative (identifies skills college students are expected to have in order to be successful in entry level college courses) ● UBD philosophy for standards (KUD) ● Standards display an integration of content and the practice of science. ● Standards are measurable. ● Standards are not biased but instead address diversity and equity. ● Physical Science, Life Science and Earth and Space Sciences ● Practice of science, apply technical skills, and communicate using scientific reasoning
Organization, Page 2	● Performance Expectations ● Science and Engineering Practices ● Disciplinary Core Ideas ● Crosscutting Concepts

Life Science Performance Expectations

Performance Expectation (PE) Coding for Proposed MLS	**Proposed MLS Standard**	**Feedback** **Keep as Proposed will be Bold. Evidence is provided in support of the structure used by the workgroup.** **Where feedback is suggested, the box will be light gray.**
MS-LS1-1	Provide evidence that organisms (unicellular and multicellular) are made of cells and that a single cell must carry out all of the basic functions of life. [Clarification Statement: Emphasis is on developing evidence that living things are made of cells, distinguishing between living and non-living things, and understanding that living things may be made of one cell or many and varied cells.]	This wording establishes a misconception. The portion that states "a single cell must carry out all of the basic functions of life" is inaccurate. At maturity, not all cells fit that definition (i.e., a red blood cell). A better wording of the standard would be "Conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells." The clarification statement is fine.
MS-LS1-2	Develop and use a model to describe the function of a cell as a whole and ways parts of the cells contribute to that function. [Clarification Statement: Emphasis is on the cell functioning as a whole system and the primary role of identified parts of the cell, specifically the nucleus, chloroplasts, mitochondria, cell membrane, and cell wall.] [Assessment Boundary: Assessment of organelle structure/function relationships is limited to the cell wall and cell membrane.	**Keep as proposed.** This format is based upon the research-based three-dimensional structure for how students develop understanding in science. By embedding the content (disciplinary core idea) with the practices of science and overarching themes (cross-cutting concepts). This format is based upon decades of research which is compiled in A Framework for K-12 Science Education. The content was addressed in the previous GLEs but the standard has been updated based upon research on how

	Assessment of the function of the other organelles is limited to their relationship to the whole cell. Assessment does not include the biochemical function of cells or cell parts.]	students learn and understand science best. The new format also ensures the standard is not culturally biased but represents equity in science for all.
MS-LS1-3	Develop an argument supported by evidence for how multicellular organisms are organized by varying levels of complexity; cells, tissue, organs, organ systems.	Although it is very good that argumentation is included, the rest of this standard is very specific and does not leave as much room for development of an argument as the following: "Use argument supported by evidence for how the body is a system of interacting sub-systems composed of groups of cells."
MS-LS1-4	Present evidence that body systems interact to carry out key body functions, including providing nutrients and oxygen to cells, removing carbon dioxide and waste from cells and the body, controlling body motion/activity and coordination, and protecting the body. [Assessment Boundary: Body systems are limited to the circulatory, excretory, digestive, respiratory, muscular/skeletal and nervous systems. Emphasis is on the function and interactions of the body systems, not specific body parts and organs or one body system independent of others.]	This standard should really be combined with the proposed suggestion MS-LS1-3. Could use the suggested change above. "Use argument supported by evidence for how the body is a system of interacting sub-systems composed of groups of cells."
MS-LS1-5	Construct an explanation for how characteristic animal behaviors as well as	**Keep as proposed.** This format is based upon the research-based three-dimensional structure for how

	specialized plant structures affect the probability of successful reproduction of animals and plants respectively. [Clarification Statement: Examples of animal behaviors that affect the probability of animal reproduction could include nest building to protect young from cold, herding of animals to protect young from predators, and vocalization of animals and colorful plumage to attract mates for breeding. Examples of animal behaviors that affect the probability of plant reproduction could include transferring pollen or seeds; and, creating conditions for seed germination and growth. Examples of plant structures that affect the probability of plant reproduction could include bright flowers attracting butterflies that transfer pollen, flower nectar and odors that attract insects that transfer pollen, and hard shells on nuts that squirrels bury.] [Assessment Boundary: Assessment does not include natural selection.]	students develop understanding in science. By embedding the content (disciplinary core idea) with the practices of science and overarching themes (cross-cutting concepts). This format is based upon decades of research which is compiled in A Framework for K-12 Science Education. The content was addressed in the previous GLEs but the standard has been updated based upon research on how students learn and understand science best. The new format also ensures the standard is not culturally biased but represents equity in science for all.
MS-LS1-6	Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms. [Clarification Statement: Examples of local environmental conditions could include availability of food, light, space, and water. Examples of genetic factors could include large breed cattle and species of grass affecting growth of organisms. Examples of	**Keep as proposed.** This format is based upon the research-based three-dimensional structure for how students develop understanding in science. By embedding the content (disciplinary core idea) with the practices of science and overarching themes (cross-cutting concepts). This format is based upon decades of research which is compiled in A Framework for K-12 Science Education.

	evidence could include drought decreasing plant growth, fertilizer increasing plant growth, different varieties of plant seeds growing at different rates in different conditions, and fish growing larger in large ponds than they do in small ponds.] [Assessment Boundary: Assessment does not include genetic mechanisms, gene regulation, or biochemical processes.]	In the crosswalk to the current GLEs, this standard is noted as a new standard but that is incorrect. The content was addressed in the previous GLEs in terms of how life processes can be disrupted by disease. The crosswalk is incorrect for this information and this standard. The new format also ensures the standard is not culturally biased but represents equity in science for all.
		Middle school students should be exposed to a conceptual understanding of photosynthesis and cellular respiration in terms of the cycling of matter and the flow of energy in and out of organisms as well as the purpose of each process. They do not need to go into specifics and assessment does not need to include the details of the chemical reactions for photosynthesis and cellular respiration. Assessment does not need to include the biochemical mechanisms.
MS-LS2-1	Analyze and interpret data to provide evidence for the effects of resource availability on individual organisms and populations of organisms in an ecosystem. [Clarification Statement: Emphasis is on cause and effect relationships between resources and growth of individual organisms and the numbers of organisms in ecosystems during periods of abundant and scarce resources.].	**Keep as proposed.** This format is based upon the research-based three-dimensional structure for how students develop understanding in science. By embedding the content (disciplinary core idea) with the practices of science and overarching themes (cross-cutting concepts). This format is based upon decades of research which is compiled in A Framework for K-12 Science Education. The content was addressed in the previous GLEs but the standard has been updated based upon research on how students learn and understand science best. The new

		format also ensures the standard is not culturally biased but represents equity in science for all.
MS-LS2-2	Construct an explanation that predicts the patterns of interactions among and between the biotic and abiotic factors in a given ecosystem. [Clarification Statement: Relationships may include competition, predation, and symbiosis.]	**Keep as proposed.** This format is based upon the research-based three-dimensional structure for how students develop understanding in science. By embedding the content (disciplinary core idea) with the practices of science and overarching themes (cross-cutting concepts). This format is based upon decades of research which is compiled in A Framework for K-12 Science Education. The content was addressed in the previous GLEs but the standard has been updated based upon research on how students learn and understand science best. The new format also ensures the standard is not culturally biased but represents equity in science for all.
MS-LS2-3	Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem. [Clarification Statement: Emphasis is on describing the conservation of matter and flow of energy into and out of various ecosystems, including food chains and food webs.] [Assessment Boundary: Assessment does not include the use of chemical reactions to describe the processes.]	**Keep as proposed.** This format is based upon the research-based three-dimensional structure for how students develop understanding in science. By embedding the content (disciplinary core idea) with the practices of science and overarching themes (cross-cutting concepts). This format is based upon decades of research which is compiled in A Framework for K-12 Science Education. The content was addressed in the previous GLEs but the standard has been updated based upon research on how students learn and understand science best. The new format also ensures the standard is not culturally biased but represents equity in science for all.

MS-LS2-4	Construct an argument supported by empirical evidence that explains how changes to physical or biological components of an ecosystem affect populations. [Clarification Statement: Emphasis is on recognizing patterns in data and making inferences about changes in populations, defining the boundaries of the system, and on evaluating empirical evidence supporting arguments about changes to ecosystems.]	**Keep as proposed.** This format is based upon the research-based three-dimensional structure for how students develop understanding in science. By embedding the content (disciplinary core idea) with the practices of science and overarching themes (cross-cutting concepts). This format is based upon decades of research which is compiled in A Framework for K-12 Science Education. The content was addressed in the previous GLEs but the standard has been updated based upon research on how students learn and understand science best. The new format also ensures the standard is not culturally biased but represents equity in science for all.
MS-LS2-5	Evaluate benefits and limitations of differing design solutions for maintaining an ecosystem.* [Clarification Statement: Examples of design solutions could include water, land, and species protection, and the prevention of soil erosion. Examples of design solution constraints could include scientific, economic, and social considerations.]	**Keep as proposed but prefer the addition of "maintaining biodiversity and ecosystem services."** This format is based upon the research-based three-dimensional structure for how students develop understanding in science. By embedding the content (disciplinary core idea) with the practices of science and overarching themes (cross-cutting concepts). This format is based upon decades of research which is compiled in A Framework for K-12 Science Education. The content was addressed in the previous GLEs but the standard has been updated based upon research on how students learn and understand science best. The new format also ensures the standard is not culturally biased but represents equity in science for all.
		To eliminate the entire disciplinary core idea of Heredity:

		Inheritance and Variation of Traits will not only interfere with coherence and developing deep understanding of other concepts but it will also remove one of the key biological big ideas from the middle school curriculum. An understanding of genetics and heredity is essential for life science. Students should not wait until high school to begin developing their knowledge base in this subject area given all the relevant issues connected to the big idea. Students should learn to distinguish between asexual and sexual reproduction and the impact each type has on the transfer of genetic information to offspring. Students should have a conceptual understanding of genes and how they control the production of proteins which affects traits expressed in an organism. Students should understand that mutations can be helpful, harmful, or have no effect. Students should understand the importance of variation. They should also develop a basic understanding of heredity and inheritance.
MS-LS4-1	Analyze and interpret evidence from the fossil record to infer patterns of environmental change resulting in extinction and changes to life forms throughout the history of the Earth. [Clarification Statement: Examples of evidence include sets of fossils that indicate an environment, anatomical structures that indicate the function of an organism in the environment, and fossilized tracks that indicate behavior of organisms.] [Assessment Boundary: Assessment does	The focus should be on the patterns of evidence students analyze. Environmental change is just one component. This evidence should also document the existence of certain species and the diversity of life. This format is based upon the research-based three-dimensional structure for how students develop understanding in science. By embedding the content (disciplinary core idea) with the practices of science and overarching themes (cross-cutting concepts). This format is based upon decades of research which is compiled in

	not include the names of individual species, geological eras in the fossil record, nor mechanisms for extinction or speciation.]	A Framework for K-12 Science Education. The content was addressed in the previous GLEs but the standard has been updated based upon research on how students learn and understand science best. The new format also ensures the standard is not culturally biased but represents equity in science for all.
MS-LS4-2	Construct an explanation based on evidence that describes how genetic variations of traits in a population increase some individuals' probability of surviving and reproducing in a specific environment. [Clarification Statement: Emphasis is on using simple probability statements and proportional reasoning to construct explanations.]	**Keep as proposed.** This format is based upon the research-based three-dimensional structure for how students develop understanding in science. By embedding the content (disciplinary core idea) with the practices of science and overarching themes (cross-cutting concepts). This format is based upon decades of research which is compiled in A Framework for K-12 Science Education. The content was addressed in the previous GLEs but the standard has been updated based upon research on how students learn and understand science best. The new format also ensures the standard is not culturally biased but represents equity in science for all.
		A standard that allows students to analyze and interpret patterns in other evidences to be able to construct an argument that leads to an explanation for MS-LS4-2 is needed. Students should not be using the fossil record alone as evidence. Part of this practice is encouraging students to examine multiple lines of evidence.
MS-LS4-3	Gather and synthesize information about the technologies that have changed the way	Gene therapy should be added to MS-LS4-3. This is yet another way that genetic disease can be addressed in the

	humans influence the inheritance of desired traits in organisms. [Clarification Statement: Emphasis is on synthesizing information from reliable sources about the influence of humans on genetic outcomes in artificial selection (such as genetic modification, animal husbandry, and farming practices).]	curriculum. These topics are not only engaging for students but they are also important for them to understand from a bioethics perspective. Students need to be informed so they will be able to make decisions as they become adults and as they eventually exercise their responsibilities as citizens. Keep as proposed with slight adjustment. This format is based upon the research-based three-dimensional structure for how students develop understanding in science. By embedding the content (disciplinary core idea) with the practices of science and overarching themes (cross-cutting concepts). This format is based upon decades of research which is compiled in A Framework for K-12 Science Education. The content was addressed in the previous GLEs but the standard has been updated based upon research on how students learn and understand science best. The new format also ensures the standard is not culturally biased but represents equity in science for all.
MS-LS4-4	Interpret graphical representations to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time.	Graphs should not be the only evidence to support this explanation. The standard (MS-LS4-4) should be changed to "Use and interpret mathematical representations to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time. [Clarification statement: Emphasis is on using mathematical models, probability statements, and proportional reasoning to support explanations of trends in changes to populations over time.] [Assessment Boundary: Assessment does not

		include Hardy-Weinberg calculations.] By eliminating the probability and proportional reasoning elements, the standard that is proposed reduces interdisciplinary opportunities between math and science. Science provides context for applications of math. It is essential to make these connections whenever possible. These simple mathematical representations also illustrate and provide evidence for the explanation, helping students understand the scientific principle.

Earth Science Performance Expectations

Performance Expectation (PE) Coding	**Proposed MLS Standard**	**Feedback**
MS-ESS1-1	Develop and use a model of the Earth-sun-moon system to explain the cyclic patterns of lunar phases and eclipses of the sun and moon. [Clarification Statement: Examples of models can be physical, graphical, or conceptual and should emphasize relative positions and distances.]	**Keep as proposed.** This format is based upon the research-based three-dimensional structure for how students develop understanding in science. By embedding the content (disciplinary core idea) with the practices of science and overarching themes (cross-cutting concepts). This format is based upon decades of research which is compiled in A Framework for K-12 Science Education.

		The content was addressed in the previous GLEs but the standard has been updated based upon research on how students learn and understand science best. The new format also ensures the standard is not culturally biased but represents equity in science for all.
MS-ESS1-2	Develop and use a model of the Earth-sun system to explain the cyclical pattern of seasons, which includes the Earth's tilt and directional angle of sunlight on different areas of Earth across the year. [Clarification Statement: Examples of models can be physical, graphical, or conceptual.]	**Keep as proposed.** This format is based upon the research-based three-dimensional structure for how students develop understanding in science. By embedding the content (disciplinary core idea) with the practices of science and overarching themes (cross-cutting concepts). This format is based upon decades of research which is compiled in A Framework for K-12 Science Education. The content was addressed in the previous GLEs but the standard has been updated based upon research on how students learn and understand science best. The new format also ensures the standard is not culturally biased but represents equity in science for all.
MS-ESS1-3	Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system. [Clarification Statement: Emphasis for the model is on gravity as the force that holds together the solar system and Milky Way galaxy and controls orbital motions within them. Examples of models can be physical or conceptual.] [Assessment Boundary: Assessment does not include Kepler's Laws of orbital motion or the apparent retrograde	**Keep as proposed.** This format is based upon the research-based three-dimensional structure for how students develop understanding in science. By embedding the content (disciplinary core idea) with the practices of science and overarching themes (cross-cutting concepts). This format is based upon decades of research which is compiled in A Framework for K-12 Science Education. The content was addressed in the previous GLEs but the standard has been updated based upon research on how

	motion of the planets as viewed from Earth.]	students learn and understand science best. The new format also ensures the standard is not culturally biased but represents equity in science for all.
MS-ESS1-4	Analyze and interpret data to determine scale properties of objects in the solar system. [Clarification Statement: Examples of scale properties include the sizes of an object's layers (such as crust and atmosphere), surface features (such as volcanoes), and orbital radius. Examples of data include statistical information, drawings and photographs, and models.] [Assessment Boundary: Assessment does not include recalling facts about properties of the planets and other solar system bodies.]	**Keep as proposed.** This format is based upon the research-based three-dimensional structure for how students develop understanding in science. By embedding the content (disciplinary core idea) with the practices of science and overarching themes (cross-cutting concepts). This format is based upon decades of research which is compiled in A Framework for K-12 Science Education. The content was addressed in the previous GLEs but the standard has been updated based upon research on how students learn and understand science best. The new format also ensures the standard is not culturally biased but represents equity in science for all.
MS-ESS1-5	Construct a scientific explanation based on evidence from rock strata for how the geologic time scale is used to organize Earth's history. [Clarification Statement: Emphasis is on how analyses of rock formations and the fossils they contain are used to establish relative ages of major events in Earth's history. Examples of Earth's major events could range from being very recent (such as the last Ice Age or the earliest fossils of homo sapiens) to very old (such as the formation of Earth or the earliest evidence of life). Examples can	**Keep as proposed.** This format is based upon the research-based three-dimensional structure for how students develop understanding in science. By embedding the content (disciplinary core idea) with the practices of science and overarching themes (cross-cutting concepts). This format is based upon decades of research which is compiled in A Framework for K-12 Science Education. The content was addressed in the previous GLEs but the standard has been updated based upon research on how students learn and understand science best. The new format also ensures the standard is not culturally biased

	include the formation of mountain chains and ocean basins, the evolution or extinction of particular living organisms, or significant volcanic eruptions.] [Assessment Boundary: Assessment does not include recalling the names of specific periods or epochs and events within them.]	but represents equity in science for all.
MS-ESS2-1	Develop and use a model to illustrate that energy from the Earth's interior drives convection which cycles Earth's crust leading to melting, crystallization, weathering and deformation of large rock formations, including generation of ocean sea floor at ridges, submergence of ocean sea floor at trenches, mountain building and active volcanic chains. [Clarification Statement: The emphasis is on large-scale cycling resulting from plate tectonics that includes changes in rock types through erosion, heat and pressure.] [Assessment Boundary: Assessment does not include specific mechanisms of plate tectonics, the identification and naming of minerals or rock types, nor rote memorization of the "rock cycle".]	This standard (MS-ESS2-1) is verbose. The purpose of the clarification statement is to include the details and examples of what is meant by the standard. By putting all those components in the standard, the flexibility for assessment is affected. Perhaps simplify the standard and place the standard components in the clarification statement. "Develop and use a model to describe the cycling of Earth's materials and the flow of energy that drives this process. [Clarification Statement: Emphasis is on the processes of melting, crystallization, weathering, deformation, and sedimentation, which act together to form minerals and rocks through the cycling of Earth's materials.] [Assessment Boundary: Assessment does not include the identification and naming of mineral.]
MS-ESS2-2	Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales. [Clarification Statement: Emphasis is on how processes	**Keep as proposed.** This format is based upon the research-based three-dimensional structure for how students develop understanding in science. By embedding the content (disciplinary core idea) with the practices of science and overarching themes

	change Earth's surface at time and spatial scales that can be large (such as slow plate motions or the uplift of large mountain ranges) or small (such as rapid landslides or microscopic geochemical reactions), and how many geoscience processes (such as earthquakes, volcanoes, and meteor impacts) usually behave gradually but are punctuated by catastrophic events. Examples of geoscience processes include surface weathering and deposition by the movements of water, ice, and wind. Emphasis is on geoscience processes that shape local geographic features, where appropriate.]	(cross-cutting concepts). This format is based upon decades of research which is compiled in A Framework for K-12 Science Education. The content was addressed in the previous GLEs but the standard has been updated based upon research on how students learn and understand science best. The new format also ensures the standard is not culturally biased but represents equity in science for all.
MS-ESS2-3	Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions. [Clarification Statement: Examples of data include similarities of rock and fossil types on different continents, the shapes of the continents (including continental shelves), and the locations of ocean structures (such as ridges, fracture zones, and trenches).] [Assessment Boundary: Paleomagnetic anomalies in oceanic and continental crust are not assessed.]	**Keep as proposed.** This format is based upon the research-based three-dimensional structure for how students develop understanding in science. By embedding the content (disciplinary core idea) with the practices of science and overarching themes (cross-cutting concepts). This format is based upon decades of research which is compiled in A Framework for K-12 Science Education. The content was addressed in the previous GLEs but the standard has been updated based upon research on how students learn and understand science best. The new format also ensures the standard is not culturally biased but represents equity in science for all.
MS-ESS2-4	Design and develop a model to describe the	By adding "design and develop a model," rather than

	cycling of water through Earth's systems driven by energy from the sun and the force of gravity. [Clarification Statement: Emphasis is on the ways water changes its state as it moves through the multiple pathways of the hydrologic cycle. Examples of models can be conceptual or physical.] [Assessment Boundary: A quantitative understanding of the latent heats of vaporization and fusion is not assessed.]	simply “Develop a model,” the standard (MS-ESS2-4) becomes more difficult to assess at the state level. Keep as proposed with possible minor change above. This format is based upon the research-based three-dimensional structure for how students develop understanding in science. By embedding the content (disciplinary core idea) with the practices of science and overarching themes (cross-cutting concepts). This format is based upon decades of research which is compiled in A Framework for K-12 Science Education. The content was addressed in the previous GLEs but the standard has been updated based upon research on how students learn and understand science best. The new format also ensures the standard is not culturally biased but represents equity in science for all.
MS-ESS2-5	Research, collect, and analyze data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions. [Clarification Statement: Emphasis is on how air masses flow from regions of high pressure to low pressure, causing weather (defined by temperature, pressure, humidity, precipitation, and wind) at a fixed location to change over time, and how sudden changes in weather can result when different air masses collide. Emphasis is on how weather can be predicted within possible ranges. Examples of data can be provided	**Keep as proposed.** This format is based upon the research-based three-dimensional structure for how students develop understanding in science. By embedding the content (disciplinary core idea) with the practices of science and overarching themes (cross-cutting concepts). This format is based upon decades of research which is compiled in A Framework for K-12 Science Education. The content was addressed in the previous GLEs but the standard has been updated based upon research on how students learn and understand science best. The new format also ensures the standard is not culturally biased but represents equity in science for all.

	to students (such as weather maps, diagrams, and visualizations) or obtained through laboratory experiments (such as with condensation).] [Assessment Boundary: Assessment does not include recalling the names of cloud types or weather symbols used on weather maps or the reported diagrams from weather stations.]	
MS-ESS2-6	Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates. [Clarification Statement: Emphasis is on how patterns vary by latitude, altitude, and geographic land distribution. Emphasis of atmospheric circulation is on the sunlight-driven latitudinal banding, the Coriolis effect, and resulting prevailing winds; emphasis of ocean circulation is on the transfer of heat by the global ocean convection cycle, which is constrained by the Coriolis effect and the outlines of continents. Examples of models can be diagrams, maps and globes, or digital representations.] [Assessment Boundary: Assessment does not include the dynamics of the Coriolis effect.]	**Keep as proposed.** This format is based upon the research-based three-dimensional structure for how students develop understanding in science. By embedding the content (disciplinary core idea) with the practices of science and overarching themes (cross-cutting concepts). This format is based upon decades of research which is compiled in A Framework for K-12 Science Education. The content was addressed in the previous GLEs but the standard has been updated based upon research on how students learn and understand science best. The new format also ensures the standard is not culturally biased but represents equity in science for all.
MS-ESS3-1	Construct a scientific explanation based on evidence for how the uneven distributions of	**Keep as proposed.** This format is based upon the research-based three-dimensional structure for how

	Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes and human activity. [Clarification Statement: Emphasis is on how these resources are limited and typically non-renewable, and how their distributions are significantly changing as a result of removal by humans. Examples of uneven distributions of resources as a result of past processes include but are not limited to petroleum (locations of the burial of organic marine sediments and subsequent geologic traps), metal ores (locations of past volcanic and hydrothermal activity associated with subduction zones), and soil (locations of active weathering and/or deposition of rock).]	students develop understanding in science. By embedding the content (disciplinary core idea) with the practices of science and overarching themes (cross-cutting concepts). This format is based upon decades of research which is compiled in A Framework for K-12 Science Education. The content was addressed in the previous GLEs but the standard has been updated based upon research on how students learn and understand science best. The new format also ensures the standard is not culturally biased but represents equity in science for all.
MS-ESS3-2	Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects. [Clarification Statement: Emphasis is on how some natural hazards, such as volcanic eruptions and severe weather, are preceded by phenomena that allow for reliable predictions, but others, such as earthquakes, occur suddenly and with no notice, and thus are not yet predictable. Examples of natural hazards can be taken from interior processes (such as earthquakes and volcanic eruptions),	**Keep as proposed**. This format is based upon the research-based three-dimensional structure for how students develop understanding in science. By embedding the content (disciplinary core idea) with the practices of science and overarching themes (cross-cutting concepts). This format is based upon decades of research which is compiled in A Framework for K-12 Science Education. The content was addressed in the previous GLEs but the standard has been updated based upon research on how students learn and understand science best. The new format also ensures the standard is not culturally biased but represents equity in science for all.

	surface processes (such as mass wasting and tsunamis), or severe weather events (such as hurricanes, tornadoes, and floods). Examples of data can include the locations, magnitudes, and frequencies of the natural hazards. Examples of technologies can be global (such as satellite systems to monitor hurricanes or forest fires) or local (such as building basements in tornado-prone regions or reservoirs to mitigate droughts).]	
MS-ESS3-3	Analyze data to define the relationship for how increases in human population and per-capita consumption of natural resources impact Earth's systems. [Clarification Statement: Examples of data include grade-appropriate databases on human populations and the rates of consumption of food and natural resources (such as freshwater, mineral, and energy). Examples of impacts can include changes to the appearance, composition, and structure of Earth's systems as well as the rates at which they change.]	The choice of practice is limiting for MS-ESS3-3. If students were able to construct an argument supported by evidence as the end result here, then they would have the opportunity to engage in the collection of multiple and varied types of evidence. To state "analyze data" as the end goal is restrictive in terms of the types of research, investigations and learning students can perform on this important and relevant topic. The three-dimensional format is still conducive to developing science literacy but to develop deeper understanding, the practice of argumentation is a better choice here with student engaging in multiple practices to collect evidence for the argument. That flexibility also aids in assessment options.
MS-ESS3-4	Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.* [Clarification Statement: Examples of the design process include examining human	**Keep as proposed.** This format is based upon the research-based three-dimensional structure for how students develop understanding in science. By embedding the content (disciplinary core idea) with the practices of science and overarching themes

	environmental impacts, assessing the kinds of solutions that are feasible, and designing and evaluating solutions that could reduce that impact. Examples of human impacts can include water usage (such as the withdrawal of water from streams and aquifers or the construction of dams and levees), land usage (such as urban development, agriculture, or the removal of wetlands), and pollution (such as of the air, water, or land).]	(cross-cutting concepts). This format is based upon decades of research which is compiled in A Framework for K-12 Science Education. The content was addressed in the previous GLEs but the standard has been updated based upon research on how students learn and understand science best. The new format also ensures the standard is not culturally biased but represents equity in science for all.
MS-ESS3-5	Analyze evidence of the factors that have caused the change in global temperatures over the past century. [Clarification Statement: Examples of factors include human activities (such as fossil fuel combustion, cement production, and agricultural activity) and natural processes (such as changes in incoming solar radiation or volcanic activity). Examples of evidence can include tables, graphs, and maps of global and regional temperatures, atmospheric levels of gases such as carbon dioxide and methane, and the rates of human activities.]	**Keep as proposed.** This format is based upon the research-based three-dimensional structure for how students develop understanding in science. By embedding the content (disciplinary core idea) with the practices of science and overarching themes (cross-cutting concepts). This format is based upon decades of research which is compiled in A Framework for K-12 Science Education. The content was addressed in the previous GLEs but the standard has been updated based upon research on how students learn and understand science best. The new format also ensures the standard is not culturally biased but represents equity in science for all.

Physical Science Performance Expectations

Performance	Proposed MLS Standard	Feedback

Expectation (PE) Coding		
MS-PS1-1	MSPS1-1. Develop models to describe the atomic composition of simple molecules and extended structures. [Clarification Statement: Emphasis is on developing models of molecules that vary in complexity. Examples of simple molecules could include ammonia and methanol. Examples of extended structures could include sodium chloride or diamonds. Examples of molecular-level models could include drawings, 3D ball and stick structures, or computer representations showing different molecules with different types of atoms.] [Assessment Boundary: Assessment does not include valence electrons and bonding energy, discussing the ionic nature of subunits of complex structures, or a complete depiction of all individual atoms in a complex molecule or extended structure.]	**Keep as proposed.** This format is based upon the research-based three-dimensional structure for how students develop understanding in science. By embedding the content (disciplinary core idea) with the practices of science and overarching themes (crosscutting concepts). This format is based upon decades of research which is compiled in A Framework for K-12 Science Education. This research has been based upon the work of The National Academies (National Academy of Sciences, National Academy of Engineering, Institute of Medicine, National Research Council). Science is a performance-based discipline in need of performance-based standards. These performance expectations allow for the needed shift for both STEM (Science, Technology, Engineering, and Mathematics) integration as well as a solid foundation of science literacy for all students. The content was addressed in the previous GLEs but the standard has been updated based upon research on how students learn and understand science best. The new format also ensures the standard is not culturally biased but represents equity in science for all.
MS-PS1-2	Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred. [Clarification Statement: Examples of reactions could include burning sugar or steel wool, fat	**Keep as proposed.** This format is based upon the research-based three-dimensional structure for how students develop understanding in science. By embedding the content (disciplinary core idea) with the practices of science and overarching themes (cross-cutting concepts). This format is based upon

	reacting with sodium hydroxide, and mixing zinc with hydrogen chloride.] [Assessment Boundary: Assessment is limited to analysis of the following properties: density, melting point, boiling point, solubility, flammability, and odor.]	decades of research which is compiled in A Framework for K-12 Science Education. The content was addressed in the previous GLEs but the standard has been updated based upon research on how students learn and understand science best. The new format also ensures the standard is not culturally biased but represents equity in science for all.
MS-PS1-3	Gather, analyze, and present information to describe that synthetic materials come from natural resources and how they impact society. [Clarification Statement: Emphasis is on natural resources that undergo a chemical process to form the synthetic material. Examples of new materials could include new medicine, foods, and alternative fuels.] [Assessment Boundary: Assessment is limited to qualitative information.]	**Keep as proposed.** This format is based upon the research-based three-dimensional structure for how students develop understanding in science. By embedding the content (disciplinary core idea) with the practices of science and overarching themes (cross-cutting concepts). This format is based upon decades of research which is compiled in A Framework for K-12 Science Education. The new format also ensures the standard is not culturally biased but represents equity in science for all. This new standard for physical science allows for real-world STEM applications and connections to other science disciplines. These are the much needed connections that need to occur for students to understand that science concepts do not occur in isolation.
MS-PS1-4	Develop a model that describes changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed. [Clarification Statement: Emphasis is on qualitative molecular-level models of solids, liquids, and gases to show	**Keep as proposed.** This format is based upon the research-based three-dimensional structure for how students develop understanding in science. By embedding the content (disciplinary core idea) with the practices of science and overarching themes (cross-cutting concepts). This format is based upon

	that adding or removing thermal energy increases or decreases kinetic energy of the particles until a change of state occurs. Examples of models could include drawings and diagrams. Examples of particles could include molecules or inert atoms. Examples of pure substances could include water, carbon dioxide, and helium.]	decades of research which is compiled in A Framework for K-12 Science Education. The content was addressed in the previous GLEs but the standard has been updated based upon research on how students learn and understand science best. The new format also ensures the standard is not culturally biased but represents equity in science for all.
MS-PS1-5	Develop and use a model to describe how the total number of atoms remains the same during a chemical reaction and thus mass is conserved. [Clarification Statement: Emphasis is on law of conservation of matter and on physical models or drawings, including digital forms that represent atoms.] [Assessment Boundary: Assessment does not include the use of atomic masses, balancing symbolic equations, or intermolecular forces.]	**Keep as proposed.** This format is based upon the research-based three-dimensional structure for how students develop understanding in science. By embedding the content (disciplinary core idea) with the practices of science and overarching themes (cross-cutting concepts). This format is based upon decades of research which is compiled in A Framework for K-12 Science Education. The content was addressed in the previous GLEs but the standard has been updated based upon research on how students learn and understand science best. The new format also ensures the standard is not culturally biased but represents equity in science for all.
MS-PS1-6	Construct, test, and modify a device that either releases or absorbs thermal energy by chemical processes.* [Clarification Statement: Emphasis is on the design, controlling the transfer of energy to the environment, and modification of a device using factors such as type and concentration of a substance. Examples of designs could	**Keep as proposed.** This format is based upon the research-based three-dimensional structure for how students develop understanding in science. By embedding the content (disciplinary core idea) with the practices of science and overarching themes (cross-cutting concepts). This format is based upon decades of research which is compiled in A Framework for K-12 Science Education. The new format also ensures

	involve chemical reactions such as dissolving ammonium chloride or calcium chloride.] [Assessment Boundary: Assessment is limited to the criteria of amount, time, and temperature of substance in testing the device.]	the standard is not culturally biased but represents equity in science for all. This specific standard was not present in the former GLEs but the content was included. This standard allows for problem-solving, real-world STEM applications, and the development of skills for college and career readiness.
MS-PS2-1	Apply physics principles to design a solution that minimizes the force of an object during a collision and develop an evaluation of the solution.* [Assessment Boundary: Assessment is limited to vertical or horizontal interactions in one dimension.]	The proposed wording could be changed to the following: Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects. Examples could include the impact of collisions between two cars, between a car and stationary objects, and between a meteor and a space vehicle. The concept is the same but this wording is clearer with a clarification statement. This concept is one that was addressed in the previous GLEs but the new format of the standards is more conducive to how students learn and understand science.
MS-PS2-2	Plan and conduct an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object. [Clarification Statement: Emphasis is on balanced (Newton's First Law) and unbalanced forces in a system, qualitative comparisons of forces, mass and changes in motion (Newton's Second Law), frame of reference, and specification of units.]	To make this performance expectation assessable at the state level, simply removing the words "and conduct" would work or denote that students could be assessed at the local level on conducting the investigation and limited to planning the investigation on a state assessment item. This concept is one that was addressed in the previous GLEs but the new format of the standards is more conducive to how students learn and understand science.

	[Assessment Boundary: Assessment is limited to forces and changes in motion in one-dimension in an inertial reference frame and to change in one variable at a time. Assessment does not include the use of trigonometry.]	Overall, the standard should be kept but perhaps with slight modification noted above.
MS-PS2-3	Analyze diagrams and collect data to determine the factors that affect the strength of electric and magnetic forces. [Clarification Statement: Examples of devices that use electric and magnetic forces could include electromagnets, electric motors, or generators. Examples of data could include the effect of the number of turns of wire on the strength of an electromagnet, or the effect of increasing the number or strength of magnets on the speed of an electric motor.] [Assessment Boundary: Assessment about questions that require quantitative answers is limited to proportional reasoning and algebraic thinking.]	The "collect data" portion will be difficult to assess at the state level but students could certainly analyze diagrams. Changing the practice to "Asking questions about data" would allow greater flexibility for assessment. This concept is one that was addressed in the previous GLEs but the new format of the standards is more conducive to how students learn and understand science. Overall, the standard should be kept but perhaps with slight modification noted above.
MS-PS2-4	Create and analyze a graph to use as evidence to support the claim that gravitational interactions depend on the mass of interacting objects. [Clarification Statement: Examples of evidence for arguments could include data generated from simulations or digital tools; and charts displaying mass, strength of interaction,	The practice should be changed to "Construct and present arguments using evidence . . . " By stating "Create and analyze a graph," the standard implies that is the only evidence that can be used to support that claim when in fact there are many types of evidence. This limits the assessment possibilities. By changing it to simply "Construct and present arguments

	distance from the Sun, and orbital periods of objects within the solar system.] [Assessment Boundary: Assessment does not include Newton's Law of Gravitation or Kepler's Laws.]	using evidence" then there are many ways that the standard could be assessed and many different practices that could be utilized as well. This concept is one that was addressed in the previous GLEs but the new format of the standards is more conducive to how students learn and understand science. Overall, the standard should be kept but perhaps with slight modification noted above.
MS-PS2-5	Conduct an investigation and evaluate the experimental design to provide evidence that electric and magnetic fields exist between objects exerting forces on each other even though the objects are not in contact. [Clarification Statement: Examples of this phenomenon could include the interactions of magnets, electrically-charged strips of tape, and electrically-charged pith balls. Examples of investigations could include first-hand experiences or simulations.] [Assessment Boundary: Assessment is limited to electric and magnetic fields, and limited to qualitative evidence for the existence of fields.]	**Keep as proposed.** This format is based upon the research-based three-dimensional structure for how students develop understanding in science. By embedding the content (disciplinary core idea) with the practices of science and overarching themes (cross-cutting concepts). This format is based upon decades of research which is compiled in A Framework for K-12 Science Education. The content was addressed in the previous GLEs but the standard has been updated based upon research on how students learn and understand science best. The new format also ensures the standard is not culturally biased but represents equity in science for all.
MS-PS3-1	Construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass of an object and to the speed of an object. [Clarification Statement: Emphasis is on descriptive relationships	**Keep as proposed.** This format is based upon the research-based three-dimensional structure for how students develop understanding in science. By embedding the content (disciplinary core idea) with the practices of science and overarching themes

	between kinetic energy and mass separately from kinetic energy and speed. Examples could include riding a bicycle at different speeds, rolling different sizes of rocks downhill, and getting hit by a whiffle ball versus a tennis ball.]	(cross-cutting concepts). This format is based upon decades of research which is compiled in A Framework for K-12 Science Education. The content was addressed in the previous GLEs but the standard has been updated based upon research on how students learn and understand science best. The new format also ensures the standard is not culturally biased but represents equity in science for all.
MS-PS3-2	Develop a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system. [Clarification Statement: Emphasis is on relative amounts of potential energy, not on calculations of potential energy. Examples of objects within systems interacting at varying distances could include: the Earth and either a roller coaster cart at varying positions on a hill or objects at varying heights on shelves, changing the direction/orientation of a magnet, and a balloon with static electrical charge being brought closer to a classmate's hair. Examples of models could include representations, diagrams, pictures, and written descriptions of systems.] [Assessment Boundary: Assessment is limited to two objects and electric, magnetic, and gravitational interactions.]	**Keep as proposed.** This format is based upon the research-based three-dimensional structure for how students develop understanding in science. By embedding the content (disciplinary core idea) with the practices of science and overarching themes (cross-cutting concepts). This format is based upon decades of research which is compiled in A Framework for K-12 Science Education. The content was addressed in the previous GLEs but the standard has been updated based upon research on how students learn and understand science best. The new format also ensures the standard is not culturally biased but represents equity in science for all.
MS-PS3-3	Apply scientific principles to design,	**Keep as proposed.** This format is based upon the

	construct, and test a device that either minimizes or maximizes thermal energy transfer.* [Clarification Statement: Examples of devices could include an insulated box, a solar cooker, and a Styrofoam cup.] [Assessment Boundary: Assessment does not include calculating the total amount of thermal energy transferred.]	research-based three-dimensional structure for how students develop understanding in science. By embedding the content (disciplinary core idea) with the practices of science and overarching themes (cross-cutting concepts). This format is based upon decades of research which is compiled in A Framework for K-12 Science Education. The content was addressed in the previous GLEs but the standard has been updated based upon research on how students learn and understand science best. The new format also ensures the standard is not culturally biased but represents equity in science for all.
MS-PS3-4	Plan and conduct an investigation to determine the relationships among the energy transferred, the type of matter, the mass, and the change in the temperature of the sample. [Clarification Statement: Examples of experiments could include comparing final water temperatures after different masses of ice melted in the same volume of water with the same initial temperature, the temperature change of samples of different materials with the same mass as they cool or heat in the environment, or the same material with different masses when a specific amount of energy is added.] [Assessment Boundary: Assessment does not include calculating the total amount of thermal energy transferred. Calculations limited to proportionate	To make this performance expectation assessable at the state level, simply removing the words “and conduct” would work or denote that students could be assessed at the local level on conducting the investigation and limited to planning the investigation on a state assessment item. This concept is one that was addressed in the previous GLEs but the new format of the standards is more conducive to how students learn and understand science. Overall, the standard should be kept but perhaps with slight modification noted above.

	thinking.]	
MS-PS3-5	Construct, use, and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object. [Clarification Statement: Examples of empirical evidence used in arguments could include an inventory or other representation of the energy before and after the transfer in the form of temperature changes or motion of object.] [Assessment Boundary: Assessment does not include calculations of energy.]	**Keep as proposed.** This format is based upon the research-based three-dimensional structure for how students develop understanding in science. By embedding the content (disciplinary core idea) with the practices of science and overarching themes (cross-cutting concepts). This format is based upon decades of research which is compiled in A Framework for K-12 Science Education. The content was addressed in the previous GLEs but the standard has been updated based upon research on how students learn and understand science best. The new format also ensures the standard is not culturally biased but represents equity in science for all.
MS-PS4-1	Students who demonstrate understanding can: MS-PS4-1. Use mathematical representations to describe a simple model for waves that includes how the amplitude of a wave is related to the energy in a wave. [Clarification Statement: Emphasis is on describing waves with both qualitative and quantitative thinking.] [Assessment Boundary: Assessment does not include electromagnetic waves and is limited to standard repeating waves.]	**Keep as proposed.** This format is based upon the research-based three-dimensional structure for how students develop understanding in science. By embedding the content (disciplinary core idea) with the practices of science and overarching themes (cross-cutting concepts). This format is based upon decades of research which is compiled in A Framework for K-12 Science Education. The content was addressed in the previous GLEs but the standard has been updated based upon research on how students learn and understand science best. The new format also ensures the standard is not culturally biased but represents equity in science for all.

MS-PS4-2	Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials. [Clarification Statement: Emphasis is on both light and mechanical waves. Examples of models could include drawings, simulations, and written descriptions.] [Assessment Boundary: Assessment is limited to qualitative applications pertaining to light and mechanical waves.]	**Keep as proposed.** This format is based upon the research-based three-dimensional structure for how students develop understanding in science. By embedding the content (disciplinary core idea) with the practices of science and overarching themes (cross-cutting concepts). This format is based upon decades of research which is compiled in A Framework for K-12 Science Education. The content was addressed in the previous GLEs but the standard has been updated based upon research on how students learn and understand science best. The new format also ensures the standard is not culturally biased but represents equity in science for all.
		Technological advancements in waves and their applications has progressed since the last adoption of standards in Missouri. There should be a standard that recognizes the digital age we live so students actually understand the science behind all the devices they use and that others use to transfer information. Students should investigate the claim that digitized signals are a more reliable way to encode and transmit information than analog signals.

Feedback for Proposed HS MLS

Front Matter **Feedback**

Overview, Page 1	● States the multiple sets of standards consulted to provide guidance and comparison for the new MLS (current MLS, NGSS, MA State Standards (2006, 2012), SC State Standards, and the MO Curriculum Alignment Initiative (identifies skills college students are expected to have in order to be successful in entry level college courses) ● UBD philosophy for standards (KUD) ● Standards display an integration of content and the practice of science. ● Standards are measurable. ● Standards are not biased but instead address diversity and equity. ● Physical Science, Life Science and Earth and Space Sciences ● Practice of science, apply technical skills, and communicate using scientific reasoning
Organization, Page 2	● Performance Expectations ● Science and Engineering Practices ● Disciplinary Core Ideas ● Crosscutting Concepts

Life Science Performance Expectations

Performance Expectation (PE) Coding for Proposed MLS	**Proposed MLS Standard**	**Feedback**
HS-LS1-1	Construct a model of how the structure of DNA	The practice of constructing a model would be

	determines the structure of proteins which carry out the essential functions of life through systems of specialized cells. [Clarification Statement: Genes are the regions in DNA that code for proteins. Basic transcription and translation explain the roles of DNA and RNA in coding the instructions for making polypeptides.] [Assessment Boundary: Assessment does not include identification of specific cell or tissue types, whole body systems, specific protein structures and functions, or the biochemistry of protein synthesis.]	difficult to assess at the state level; however, the practice of constructing an explanation would be plausible. Students could still utilize modeling to reach the end goal of constructing an explanation.
HS-LS1-2	Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms. [Clarification Statement: Emphasis is on functions at the organism system level such as nutrient uptake, water delivery, and organism movement in response to stimuli.] [Assessment Boundary: Assessment does not include interactions and functions at the molecular or chemical reaction level.]	**Keep as proposed.** This format is based upon the research-based three-dimensional structure for how students develop understanding in science. By embedding the content (disciplinary core idea) with the practices of science and overarching themes (cross-cutting concepts). This format is based upon decades of research which is compiled in A Framework for K-12 Science Education. The content was addressed in the previous GLEs but the standard has been updated based upon research on how students learn and understand science best. The new format also ensures the standard is not culturally biased but represents equity in science for all
HS-LS1-3	Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis. [Clarification Statement: Examples	**Keep as proposed** (except “stomata” should be changed to “stomate.” This format is based upon the research-based three-dimensional structure for

	of investigations could include heart rate response to exercise, stomata response to moisture and temperature, and root development in response to water levels.] [Assessment Boundary: Assessment does not include the cellular processes involved in the feedback mechanism.]	how students develop understanding in science. By embedding the content (disciplinary core idea) with the practices of science and overarching themes (cross-cutting concepts). This format is based upon decades of research which is compiled in A Framework for K-12 Science Education. The content was addressed in the previous GLEs but the standard has been updated based upon research on how students learn and understand science best. The new format also ensures the standard is not culturally biased but represents equity in science for all.
HS-LS1-4	Develop and use models to communicate the role of mitosis, cellular division, and differentiation in producing and maintaining complex organisms.[Clarification Statement: Major events of the cell cycle include cell growth, DNA replication, preparation for division, separation of chromosomes, and separation of cell contents.] [Assessment Boundary: Assessment does not include specific gene control mechanisms or rote memorization of steps of mitosis.]	**Keep as proposed.** This format is based upon the research-based three-dimensional structure for how students develop understanding in science. By embedding the content (disciplinary core idea) with the practices of science and overarching themes (cross-cutting concepts). This format is based upon decades of research which is compiled in A Framework for K-12 Science Education. The content was addressed in the previous GLEs but the standard has been updated based upon research on how students learn and understand science best. The new format also ensures the standard is not culturally biased but represents equity in science for all.
HS-LS1-5	Construct a scientific explanation based on evidence for the role of photosynthesis and	This standard actually combines the middle school performance expectations for photosynthesis and

	cellular respiration in the cycling of matter and flow of energy into and out of organisms.	cellular respiration. This standard can remain but it should still be introduced in middle school first and be a supporting standard here. Students should not see it for the first time in high school. A clarification statement would be helpful.
HS-LS1-6	Use a model to demonstrate how photosynthesis transforms light energy into stored chemical energy. [Clarification Statement: Emphasis is on illustrating inputs and outputs of matter and the transfer and transformation of energy in photosynthesis by plants and other photosynthesizing organisms. Examples of models could include diagrams, chemical equations, and conceptual models.] [Assessment Boundary: Assessment does not include specific biochemical steps.]	**Keep as proposed.** This format is based upon the research-based three-dimensional structure for how students develop understanding in science. By embedding the content (disciplinary core idea) with the practices of science and overarching themes (cross-cutting concepts). This format is based upon decades of research which is compiled in A Framework for K-12 Science Education. The content was addressed in the previous GLEs but the standard has been updated based upon research on how students learn and understand science best. The new format also ensures the standard is not culturally biased but represents equity in science for all.
HS-LS1-7	Use a model to demonstrate that cellular respiration is a chemical process whereby the bonds of molecules are broken and the bonds in new compounds are formed resulting in a net transfer of energy. [Clarification Statement: Emphasis is on the conceptual understanding of the inputs and outputs of the process of cellular respiration.] [Assessment Boundary: Assessment does not include identification of the steps or specific processes involved in cellular	**Keep as proposed.** This format is based upon the research-based three-dimensional structure for how students develop understanding in science. By embedding the content (disciplinary core idea) with the practices of science and overarching themes (cross-cutting concepts). This format is based upon decades of research which is compiled in A Framework for K-12 Science Education. The content was addressed in the previous GLEs

	respiration.]	but the standard has been updated based upon research on how students learn and understand science best. The new format also ensures the standard is not culturally biased but represents equity in science for all.
HS-LS1-8	Construct and revise an explanation based on evidence that organic macromolecules are primarily composed of six elements, where carbon, hydrogen, and oxygen atoms may combine with nitrogen, sulfur, and phosphorus to form large carbon-based molecules. [Clarification Statement: Large carbon-based molecules included are proteins, carbohydrates, nucleic acids, and lipids.] [Assessment Boundary: Assessment does not include the details of the specific chemical reactions or identification of specific macromolecules.]	This standard as written would promote a misconception. Not all organic compounds contain nitrogen, sulfur and phosphorus. A better way to word this particular performance expectation would be: "Construct and revise an explanation based on evidence for how carbon, hydrogen, and oxygen from sugar molecules may combine with other elements to form amino acids and/or other large carbon-based molecules. Clarification Statement: Emphasis is on using evidence from models and simulations to support explanations. Assessment Boundary: Assessment does not include the details of the specific chemical reactions or identification of macromolecules."
HS-LS2-1	Explain how various biotic and abiotic factors affect the carrying capacity and biodiversity of an ecosystem using mathematical and/or computational representations. [Clarification Statement: Examples of biotic factors could include relationships among individuals (e.g., feeding relationships, symbioses, competition) and disease. Examples of abiotic factors could	HS-LS2-1 is too broad and oversimplifies two ideas that would be better represented as two separate standards. Please see the suggestion below: "Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales. Clarification Statement: Emphasis is on quantitative analysis and comparison of the

	include climate and weather conditions, natural disasters, and availability of resources. Genetic diversity includes within a population and species within an ecosystem. Examples of mathematical comparisons could include graphs, charts, histograms, and population changes gathered from simulations or historical data sets.] [Assessment Boundary: Assessment does not include deriving mathematical equations to make comparisons and is limited to provided data.]	relationships among interdependent factors including boundaries, resources, climate, and competition. Examples of mathematical comparisons could include graphs, charts, histograms, and population changes gathered from simulations or historical data sets. Assessment Boundary: Assessment does not include deriving mathematical equations to make comparisons." and "Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales. Clarification Statement: Examples of mathematical representations include finding the average, determining trends, and using graphical comparisons of multiple sets of data. Assessment Boundary: Assessment is limited to provided data."
HS-LS2-2	Construct and revise an explanation based on evidence that the processes of photosynthesis, chemosynthesis, and aerobic and anaerobic respiration are responsible for the cycling of matter and flow of energy through ecosystems and that environmental conditions restrict which reactions can occur. [Clarification Statement: Examples of environmental conditions can include the availability of sunlight or oxygen.]	A lot of processes were incorporated into this standard when the intent was to truly focus on aerobic and anaerobic conditions. As is, the standard is too overwhelming.

	[Assessment Boundary: Assessment does not include the specific chemical processes of photosynthesis, chemosynthesis, of either aerobic respiration or anaerobic respiration.]	
HS-LS2-3	Communicate the pattern of the cycling of matter and the flow of energy among trophic levels in an ecosystem. [Clarification Statement: Emphasis is on using a model of stored energy in biomass to describe the transfer of energy from one trophic level to another. Emphasis is on atoms and molecules as they move through an ecosystem.] [Assessment Boundary: Assessment is limited to proportional reasoning to describe the cycling of matter and the flow of energy.]	**Keep as proposed.** This format is based upon the research-based three-dimensional structure for how students develop understanding in science. By embedding the content (disciplinary core idea) with the practices of science and overarching themes (cross-cutting concepts). This format is based upon decades of research which is compiled in A Framework for K-12 Science Education. The content was addressed in the previous GLEs but the standard has been updated based upon research on how students learn and understand science best. The new format also ensures the standard is not culturally biased but represents equity in science for all.
HS-LS2-4	Use a model that illustrates the roles of photosynthesis, cellular respiration, decomposition, and combustion to explain the cycling of carbon in its various forms among the biosphere, atmosphere, hydrosphere, and geosphere. [Clarification Statement: The primary forms of carbon include carbon dioxide, hydrocarbons, waste, and biomass. Examples of models could include simulations and mathematical and conceptual models.] [Assessment Boundary: Assessment does not	A lot of processes were incorporated into this standard when the intent should be to truly focus on photosynthesis and cellular respiration.

	include the specific chemical steps of photosynthesis, respiration, decomposition, and combustion.]	
HS-LS2-5	Evaluate the claims, evidence, and reasoning that the interactions in ecosystems maintain relatively consistent populations of species while conditions remain stable, but changing conditions may result in new ecosystem dynamics. [Clarification Statement: Examples of changes in ecosystem conditions could include modest biological or physical changes, such as moderate hunting or a seasonal flood; and extreme changes, such as volcanic eruption or sea level rise.]	**Keep as proposed.** This format is based upon the research-based three-dimensional structure for how students develop understanding in science. By embedding the content (disciplinary core idea) with the practices of science and overarching themes (cross-cutting concepts). This format is based upon decades of research which is compiled in A Framework for K-12 Science Education. The content was addressed in the previous GLEs but the standard has been updated based upon research on how students learn and understand science best. The new format also ensures the standard is not culturally biased but represents equity in science for all.
HS-LS2-6	Design, evaluate, and/or refine solutions that positively impact the environment and biodiversity.* [Clarification Statement: Examples of solutions may include captive breeding programs, habitat restoration, pollution mitigation, energy conservation, agriculture and mining programs, and ecotourism.]	**Keep as proposed.** This format is based upon the research-based three-dimensional structure for how students develop understanding in science. By embedding the content (disciplinary core idea) with the practices of science and overarching themes (cross-cutting concepts). This format is based upon decades of research which is compiled in A Framework for K-12 Science Education. The content was addressed in the previous GLEs but the standard has been updated based upon research on how students learn and understand

		science best. The new format also ensures the standard is not culturally biased but represents equity in science for all
		A standard/performance expectation is needed to address the role of group behavior such as: "Evaluate evidence for the role of group behavior on individual and species' chances to survive and reproduce. [Clarification Statement: Emphasis is on (1) distinguishing between group and individual behavior, (2) identifying evidence supporting the outcomes of group behavior, and (3) developing logical and reasonable arguments based on evidence. Examples of group behaviors could include flocking, schooling, herding, and cooperative behaviors such as hunting, migrating, and swarming.]
HS-LS3-1	Develop and use models to clarify relationships about how DNA in the form of chromosomes is passed from parents to offspring through the processes of meiosis and fertilization in sexual reproduction. [Assessment Boundary: Assessment does not include rote memorization of the phases of meiosis or the biochemical mechanism of specific steps in the process.]	**Keep as proposed.** This format is based upon the research-based three-dimensional structure for how students develop understanding in science. By embedding the content (disciplinary core idea) with the practices of science and overarching themes (cross-cutting concepts). This format is based upon decades of research which is compiled in A Framework for K-12 Science Education. The content was addressed in the previous GLEs but the standard has been updated based upon research on how students learn and understand science best. The new format also ensures the

		standard is not culturally biased but represents equity in science for all.
HS-LS3-2	Compare and contrast asexual and sexual reproduction with regard to genetic information and variation in offspring.	This standard was moved from the learning progressions of middle school. The practice of developing and using models was removed such that the three-dimensional structure is not followed as in the other standards. Since research shows that the three-dimensional framework is how students learn and develop understanding of science, this standard should be written to reflect the content, practice and crosscutting concept.
HS-LS3-3	Develop and use a model to describe why structural changes to genes (mutations) located on chromosomes may affect proteins and may result in harmful, beneficial, or neutral effects to the structure and function of the organism. [Clarification Statement: Emphasis is on conceptual understanding that changes in genetic material may result in making different proteins.] [Assessment Boundary: Assessment does not include specific changes at the molecular level, mechanisms for protein synthesis, or specific types of mutations.]	This standard was moved from the learning progressions of middle school. The point of learning progressions is to build understanding. Not establishing any basis for heredity and inheritance in middle school would not allow for developing deeper understanding. The field of genetics is too important to ignore in our standards. This standard should be returned (MS-LS3-1) to middle school and built upon in high school.
HS-LS3-4	Make and defend a claim that inheritable genetic variations may result from: (1) new genetic combinations through meiosis, (2) mutations occurring during replication, and/or (3) mutations caused by environmental factors. [Clarification Statement: Emphasis is on using data to support	**Keep as proposed.** This format is based upon the research-based three-dimensional structure for how students develop understanding in science. By embedding the content (disciplinary core idea) with the practices of science and overarching themes (cross-cutting concepts). This format is

	arguments for the way variation occurs.] [Assessment Boundary: Assessment does not include the phases of meiosis or the biochemical mechanism of specific steps in the process.]	based upon decades of research which is compiled in A Framework for K-12 Science Education. The content was addressed in the previous GLEs but the standard has been updated based upon research on how students learn and understand science best. The new format also ensures the standard is not culturally biased but represents equity in science for all.
HS-LS3-5	Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population. [Clarification Statement: Emphasis is on the use of mathematics (Punnett Squares) to describe the probability of traits as it relates to genetic and environmental factors in the expression of traits.] [Assessment Boundary: Assessment does not include Hardy -Weinberg calculations.]	**Keep as proposed.** This format is based upon the research-based three-dimensional structure for how students develop understanding in science. By embedding the content (disciplinary core idea) with the practices of science and overarching themes (cross-cutting concepts). This format is based upon decades of research which is compiled in A Framework for K-12 Science Education. The content was addressed in the previous GLEs but the standard has been updated based upon research on how students learn and understand science best. The new format also ensures the standard is not culturally biased but represents equity in science for all.
HS-LS4-1	Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence. (Clarification statement: Emphasis is on a conceptual understanding of the role each line of	**Keep as proposed.** This format is based upon the research-based three-dimensional structure for how students develop understanding in science. By embedding the content (disciplinary core idea) with the practices of science and overarching

	evidence has relating to common ancestry and biological evolution. Examples of evidence could include similarities in DNA sequences, anatomical structures, and order of appearance of structures in embryological development. Communicate could mean written report, oral discussion, etc.)	themes (cross-cutting concepts). This format is based upon decades of research which is compiled in A Framework for K-12 Science Education. The content was addressed in the previous GLEs but the standard has been updated based upon research on how students learn and understand science best. The new format also ensures the standard is not culturally biased but represents equity in science for all
HS-LS4-2	Analyze displays of pictorial data to compare patterns of similarities in the embryological development across multiple species to identify relationships not evident in the fully formed anatomy. [Clarification Statement: Emphasis is on inferring general patterns of relatedness among embryos of different organisms by comparing the macroscopic appearance of diagrams or pictures.] [Assessment Boundary: Assessment of comparisons is limited to gross appearance of anatomical structures (head, body, appendages, or tail) in embryological development.]	This standard is actually from the learning progressions of middle school and has been moved to high school. The need was expressed in the middle school life science feedback for the need for additional pieces of evidence for students to investigate and build arguments. This concept was eliminated from the middle school progression.
HS-LS4-3	Construct an explanation based on evidence that the process of evolution primarily results from four factors: (1) the potential for a species to increase in number, (2) the heritable genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for limited resources, and (4) the proliferation of	**Keep as proposed.** This format is based upon the research-based three-dimensional structure for how students develop understanding in science. By embedding the content (disciplinary core idea) with the practices of science and overarching themes (cross-cutting concepts). This format is based upon decades of research which is compiled

	those organisms that are better able to survive and reproduce in the environment. (Clarification Statement: Emphasis is on using evidence to explain the influence each of the four factors has on number of organisms, behaviors, morphology, or physiology in terms of ability to compete for limited resources and subsequent survival of individuals and adaptation of species. Examples of evidence could include mathematical models such as simple distribution graphs and proportional reasoning.) (Assessment Boundary: Assessment does not include other mechanisms of evolution, such as genetic drift, gene flow through migration, and co-evolution.)	in A Framework for K-12 Science Education. The content was addressed in the previous GLEs but the standard has been updated based upon research on how students learn and understand science best. The new format also ensures the standard is not culturally biased but represents equity in science for all
HS-LS4-4	Apply concepts of statistics and probability to support explanations that organisms with an advantageous heritable trait tend to increase in proportion to organisms lacking this trait. [Clarification Statement: Emphasis is on analyzing shifts in numerical distribution of traits and using these shifts as evidence to support explanations.] [Assessment Boundary: Assessment is limited to basic statistical and graphical analysis. Assessment does not include allele frequency calculations.]	**Keep as proposed.** This format is based upon the research-based three-dimensional structure for how students develop understanding in science. By embedding the content (disciplinary core idea) with the practices of science and overarching themes (cross-cutting concepts). This format is based upon decades of research which is compiled in A Framework for K-12 Science Education. The content was addressed in the previous GLEs but the standard has been updated based upon research on how students learn and understand science best. The new format also ensures the standard is not culturally biased but represents equity in science for all
HS-LS4-5	Construct an explanation based on evidence for	**Keep as proposed.** This format is based upon the

	how natural selection leads to adaptation of populations. [Clarification Statement: Emphasis is on using data to provide evidence for how specific biotic and abiotic differences in ecosystems (such as ranges of seasonal temperature, long-term climate change, acidity, light, geographic barriers, or evolution of other organisms) contribute to a change in gene frequency over time, leading to adaptation of populations.]	research-based three-dimensional structure for how students develop understanding in science. By embedding the content (disciplinary core idea) with the practices of science and overarching themes (cross-cutting concepts). This format is based upon decades of research which is compiled in A Framework for K-12 Science Education. The content was addressed in the previous GLEs but the standard has been updated based upon research on how students learn and understand science best. The new format also ensures the standard is not culturally biased but represents equity in science for all
HS-LS4-6	Evaluate the evidence supporting claims that changes in environmental conditions may result in: (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species. [Clarification statement: Emphasis is on determining cause and effect relationships for how changes to the environment such as deforestation, fishing, and application of fertilizers, droughts, flood, and the rate of change of the environment affect distribution or disappearance of traits in species.]	**Keep as proposed.** This format is based upon the research-based three-dimensional structure for how students develop understanding in science. By embedding the content (disciplinary core idea) with the practices of science and overarching themes (cross-cutting concepts). This format is based upon decades of research which is compiled in A Framework for K-12 Science Education. The content was addressed in the previous GLEs but the standard has been updated based upon research on how students learn and understand science best. The new format also ensures the standard is not culturally biased but represents equity in science for all
HS-LS4-7	Create or revise a model to test a solution to	**Keep as proposed.** This format is based upon the

	mitigate adverse impacts of human activity on biodiversity. [Clarification Statement: Emphasis is on designing solutions for a proposed problem related to threatened or endangered species, or to genetic variation of organisms for multiple species.]	research-based three-dimensional structure for how students develop understanding in science. By embedding the content (disciplinary core idea) with the practices of science and overarching themes (cross-cutting concepts). This format is based upon decades of research which is compiled in A Framework for K-12 Science Education. The content was addressed in the previous GLEs but the standard has been updated based upon research on how students learn and understand science best. The new format also ensures the standard is not culturally biased but represents equity in science for all

Earth Science Performance Expectations

Performance Expectation (PE) Coding for Proposed MLS	**Proposed MLS Standard**	**Feedback**
HS-ESS1-1	Develop a model based on evidence to illustrate the life span of the Sun and the role of nuclear fusion in the Sun's core to release energy in the form of radiation. [Clarification Statement: Emphasis is on the energy transfer mechanisms that allow energy from nuclear fusion in the Sun's core to reach Earth. Examples of evidence for the model include	**Keep as proposed.** This format is based upon the research-based three-dimensional structure for how students develop understanding in science. By embedding the content (disciplinary core idea) with the practices of science and overarching themes (cross-cutting concepts). This format is based upon decades of research which is

	observations of the masses and lifetimes of other stars, as well as the ways that the Sun's radiation varies due to sudden solar flares ("space weather").] [Assessment Boundary: Assessment does not include details of the atomic and sub-atomic processes involved with the Sun's nuclear fusion.]	compiled in A Framework for K-12 Science Education. The content was addressed in the previous GLEs but the standard has been updated based upon research on how students learn and understand science best. The new format also ensures the standard is not culturally biased but represents equity in science for all
HS-ESS1-2	Construct an explanation of the Big Bang theory based on astronomical evidence of light spectra, motion of distant galaxies, and composition of matter in the universe. [Clarification Statement: Emphasis is on the astronomical evidence of the red shift of light from galaxies as an indication that the universe is currently expanding, the cosmic microwave background as the remnant radiation from the Big Bang, and the observed composition of ordinary matter of the universe, primarily found in stars and interstellar gases (from the spectra of electromagnetic radiation from stars), which matches that predicted by the Big Bang theory (3/4 hydrogen and 1/4 helium).]	**Keep as proposed.** This format is based upon the research-based three-dimensional structure for how students develop understanding in science. By embedding the content (disciplinary core idea) with the practices of science and overarching themes (cross-cutting concepts). This format is based upon decades of research which is compiled in A Framework for K-12 Science Education. The content was addressed in the previous GLEs but the standard has been updated based upon research on how students learn and understand science best. The new format also ensures the standard is not culturally biased but represents equity in science for all.
HS-ESS1-3	Communicate scientific ideas about the way stars, over their life cycle, produce elements. [Clarification Statement: Emphasis is on the way nucleosynthesis, and therefore the different elements created, varies as a function of the mass	**Keep as proposed.** This format is based upon the research-based three-dimensional structure for how students develop understanding in science. By embedding the content (disciplinary core idea) with the practices of science and overarching

	of a star and the stage of its lifetime.] [Assessment Boundary: Details of the many different nucleosynthesis pathways for stars of differing masses are not assessed.]	themes (cross-cutting concepts). This format is based upon decades of research which is compiled in A Framework for K-12 Science Education. The content was addressed in the previous GLEs but the standard has been updated based upon research on how students learn and understand science best. The new format also ensures the standard is not culturally biased but represents equity in science for all.
HS-ESS1-4	Use Kepler's Law to predict the motion of orbiting objects in the solar system. [Clarification Statement: Emphasis is on Newtonian gravitational laws governing orbital motions, which apply to human-made satellites as well as planets and moons.] [Assessment Boundary: Kepler's Laws of orbital motions should not deal with more than two bodies, nor involve calculus.]	The practice of using mathematics and computational thinking is left out of the standard. To maintain the three-dimensional format, a practice should be included.
HS-ESS1-5	Evaluate evidence of the past and current movements of continental and oceanic crust, the theory of plate tectonics, and relative densities of oceanic and continental rocks to explain why continental rocks are generally much older than rocks of the ocean floor. [Clarification Statement: Examples include the ages of oceanic crust increasing with distance from mid-ocean ridges (a result of plate spreading) and the ages of North American continental crust increasing with distance away from a central ancient core (a result of past	This standard pulls some details into the actual performance expectation rather than leaving the details in the clarification statement. Simpler wording could be as follows, with the clarification statement specifying further details: "Evaluate evidence of the past and current movements of continental and oceanic crust and the theory of plate tectonics to explain the ages of crustal rocks. [Clarification Statement: Emphasis is on the ability of plate tectonics to explain the

	plate interactions).]	ages of crustal rocks. Examples include evidence of the ages of oceanic crust increasing with distance from mid-ocean ridges (a result of plate spreading) and the ages of North American continental crust increasing with distance away from a central ancient core (a result of past plate interactions).]
HS-ESS1-6	Apply scientific reasoning and evidence from ancient Earth materials, meteorites, and other planetary surfaces to construct an account of Earth's formation and early history. [Clarification Statement: Emphasis is on using available evidence within the solar system to reconstruct the early history of Earth, which formed along with the rest of the solar system 4.6 billion years ago. Examples of evidence include the absolute ages of ancient materials (obtained by radiometric dating of meteorites, moon rocks, and Earth's oldest minerals), the sizes and compositions of solar system objects, and the impact cratering record of planetary surfaces.]	**Keep as proposed.** This format is based upon the research-based three-dimensional structure for how students develop understanding in science. By embedding the content (disciplinary core idea) with the practices of science and overarching themes (cross-cutting concepts). This format is based upon decades of research which is compiled in A Framework for K-12 Science Education. The content was addressed in the previous GLEs but the standard has been updated based upon research on how students learn and understand science best. The new format also ensures the standard is not culturally biased but represents equity in science for all
HS-ESS2-1	Develop a model to illustrate how Earth's interior and surface processes (constructive and destructive) operate at different spatial and temporal scales to form continental and ocean-floor features. [Clarification Statement: Emphasis is on how the appearance of land features (such as mountains, valleys, and plateaus) and sea-floor	**Keep as proposed.** This format is based upon the research-based three-dimensional structure for how students develop understanding in science. By embedding the content (disciplinary core idea) with the practices of science and overarching themes (cross-cutting concepts). This format is based upon decades of research which is

	features (such as trenches, ridges, and seamounts) are a result of both constructive forces (such as volcanism, tectonic uplift, and orogeny) and destructive mechanisms (such as weathering, mass wasting, and coastal erosion).] [Assessment Boundary: Assessment does not include memorization of the details of the formation of specific geographic features of Earth's surface.]	compiled in A Framework for K-12 Science Education. The content was addressed in the previous GLEs but the standard has been updated based upon research on how students learn and understand science best. The new format also ensures the standard is not culturally biased but represents equity in science for all
HS-ESS2-2	Analyze geoscientific data to make the claim that one change to Earth's surface can create changes to other Earth systems.	Add clarification statement. [Clarification Statement: Examples should include climate feedbacks, such as how an increase in greenhouse gases causes a rise in global temperatures that melts glacial ice, which reduces the amount of sunlight reflected from Earth's surface, increasing surface temperatures and further reducing the amount of ice. Examples could also be taken from other system interactions, such as how the loss of ground vegetation causes an increase in water runoff and soil erosion; how dammed rivers increase groundwater recharge, decrease sediment transport, and increase coastal erosion; or how the loss of wetlands causes a decrease in local humidity that further reduces the wetland extent.] This format is based upon the research-based three-dimensional structure for how students develop understanding in science. By embedding the content (disciplinary core idea) with the

		practices of science and overarching themes (cross-cutting concepts). This format is based upon decades of research which is compiled in A Framework for K-12 Science Education. The content was addressed in the previous GLEs but the standard has been updated based upon research on how students learn and understand science best. The new format also ensures the standard is not culturally biased but represents equity in science for all
HS-ESS2-3	Develop a model based on evidence of Earth's interior to describe the cycling of matter by thermal convection. [Clarification Statement: Emphasis is on both a one-dimensional model of Earth, with radial layers determined by density, and a three-dimensional model, which is controlled by mantle convection and the resulting plate tectonics. Examples of evidence include maps of Earth's three-dimensional structure obtained from seismic waves, records of the rate of change of Earth's magnetic field (as constraints on convection in the outer core), and identification of the composition of Earth's layers from high-pressure laboratory experiments.]	**Keep as proposed.** This format is based upon the research-based three-dimensional structure for how students develop understanding in science. By embedding the content (disciplinary core idea) with the practices of science and overarching themes (cross-cutting concepts). This format is based upon decades of research which is compiled in A Framework for K-12 Science Education. The content was addressed in the previous GLEs but the standard has been updated based upon research on how students learn and understand science best. The new format also ensures the standard is not culturally biased but represents equity in science for all
HS-ESS2-4	Use a model to describe how variations in the flow of energy into and out of Earth's systems result in changes in climate. [Assessment Boundary:	A clarification statement would be helpful. Clarification Statement: Examples of the causes of

	Assessment of the results of changes in climate is limited to changes in surface temperatures, precipitation patterns, glacial ice volumes, sea levels, and biosphere distribution.]	climate change differ by timescale, over 1-10 years: large volcanic eruption, ocean circulation; 10-100s of years: changes in human activity, ocean circulation, solar output; 10-100s of thousands of years: changes to Earth's orbit and the orientation of its axis; and 10-100s of millions of years: long-term changes in atmospheric composition. This format is based upon the research-based three-dimensional structure for how students develop understanding in science. By embedding the content (disciplinary core idea) with the practices of science and overarching themes (cross-cutting concepts). This format is based upon decades of research which is compiled in A Framework for K-12 Science Education. The content was addressed in the previous GLEs but the standard has been updated based upon research on how students learn and understand science best. The new format also ensures the standard is not culturally biased but represents equity in science for all
HS-ESS2-5	Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes. [Clarification Statement: Emphasis is on mechanical and chemical investigations with water and a variety of solid materials to provide the evidence for connections between the hydrologic cycle and system	**Keep as proposed.** This format is based upon the research-based three-dimensional structure for how students develop understanding in science. By embedding the content (disciplinary core idea) with the practices of science and overarching themes (cross-cutting concepts). This format is based upon decades of research which is

	interactions commonly known as the rock cycle. Examples of mechanical investigations include stream transportation and deposition using a stream table, erosion using variations in soil moisture content, or ice wedging by the expansion of water as it freezes. Examples of chemical investigations include chemical weathering and recrystallization (by testing the solubility of different materials) or melt generation (by examining how water lowers the melting temperature of most solids).]	compiled in A Framework for K-12 Science Education. The content was addressed in the previous GLEs but the standard has been updated based upon research on how students learn and understand science best. The new format also ensures the standard is not culturally biased but represents equity in science for all
HS-ESS2-6	Develop a quantitative model to describe the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere. [Clarification Statement: Emphasis is on modeling biogeochemical cycles that include the cycling of carbon through the ocean, atmosphere, soil, and biosphere (including humans), providing the foundation for living organisms.]	**Keep as proposed.** This format is based upon the research-based three-dimensional structure for how students develop understanding in science. By embedding the content (disciplinary core idea) with the practices of science and overarching themes (cross-cutting concepts). This format is based upon decades of research which is compiled in A Framework for K-12 Science Education. The content was addressed in the previous GLEs but the standard has been updated based upon research on how students learn and understand science best. The new format also ensures the standard is not culturally biased but represents equity in science for all
HS-ESS2-7	Construct an argument based on evidence about the simultaneous coevolution of Earth's systems and life on Earth. [Clarification Statement:	**Keep as proposed.** This format is based upon the research-based three-dimensional structure for how students develop understanding in science.

	Emphasis is on the dynamic causes, effects, and feedbacks between the biosphere and Earth's other systems, whereby geoscience factors control the evolution of life, which in turn continuously alters Earth's surface. Examples of coevolution include how photosynthetic life altered the atmosphere through the production of oxygen, which in turn increased weathering rates and allowed for the evolution of animal life; how microbial life on land increased the formation of soil, which in turn allowed for the evolution of land plants; or how the evolution of corals created reefs that altered patterns of erosion and deposition along coastlines and provided habitats for new life.] [Assessment Boundary: Assessment does not include a comprehensive understanding of the mechanisms of how the biosphere interacts with all of Earth's other systems.]	By embedding the content (disciplinary core idea) with the practices of science and overarching themes (cross-cutting concepts). This format is based upon decades of research which is compiled in A Framework for K-12 Science Education. The content was addressed in the previous GLEs but the standard has been updated based upon research on how students learn and understand science best. The new format also ensures the standard is not culturally biased but represents equity in science for all
HS-ESS3-1	Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity. [Clarification Statement: Examples of key natural resources include access to fresh water, regions of fertile soils such as river deltas, and high concentrations of minerals and fossil fuels. Examples of natural hazards can be from interior processes (such as volcanic eruptions and earthquakes), surface processes (such as tsunamis, mass wasting and soil erosion), and severe weather. Examples of the results of changes	**Keep as proposed.** This format is based upon the research-based three-dimensional structure for how students develop understanding in science. By embedding the content (disciplinary core idea) with the practices of science and overarching themes (cross-cutting concepts). This format is based upon decades of research which is compiled in A Framework for K-12 Science Education. The content was addressed in the previous GLEs but the standard has been updated based upon research on how students learn and understand

	in climate that can affect populations or drive mass migrations include changes to sea level, regional patterns of temperature and precipitation, and the types of crops and livestock that can be raised.]	science best. The new format also ensures the standard is not culturally biased but represents equity in science for all
HS-ESS3-2	Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on economic, social, and environmental cost-benefit ratios.* [Clarification Statement: Emphasis is on the conservation, recycling, and reuse of resources (such as minerals and metals) where possible, and on minimizing impacts where it is not. Examples include developing best practices for agricultural soil use, mining (for coal, tar sands, and oil shales), and pumping (for petroleum and natural gas). Science knowledge indicates what can happen in natural systems—not what should happen.]	**Keep as proposed.** This format is based upon the research-based three-dimensional structure for how students develop understanding in science. By embedding the content (disciplinary core idea) with the practices of science and overarching themes (cross-cutting concepts). This format is based upon decades of research which is compiled in A Framework for K-12 Science Education. The content was addressed in the previous GLEs but the standard has been updated based upon research on how students learn and understand science best. The new format also ensures the standard is not culturally biased but represents equity in science for all
HS-ESS3-3	Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity. [Clarification Statement: Examples of factors that affect the management of natural resources include costs of resource extraction and waste management, per-capita consumption, and the development of new technologies. Examples of factors that affect human sustainability include agricultural efficiency, levels of conservation, and	**Keep as proposed.** This format is based upon the research-based three-dimensional structure for how students develop understanding in science. By embedding the content (disciplinary core idea) with the practices of science and overarching themes (cross-cutting concepts). This format is based upon decades of research which is compiled in A Framework for K-12 Science Education.

	urban planning.] [Assessment Boundary: Assessment for computational simulations is limited to using provided multi-parameter programs or constructing simplified spreadsheet calculations.]	The content was addressed in the previous GLEs but the standard has been updated based upon research on how students learn and understand science best. The new format also ensures the standard is not culturally biased but represents equity in science for all.
HS-ESS3-4	Evaluate or refine a technological solution that reduces impacts of human activities on natural systems in order to restore stability and or biodiversity of the ecosystem as well as prevent their reoccurances.* [Clarification Statement: Examples of human activities could include forest fires, acid rain, flooding, urban development, pollution, deforestation, and introduction of an invasive species.]	Spelling of "reoccurrences" This standard seems to be a combination of a life science standard and an earth science standard. For HS-ESS3-4, the following wording may be more appropriate: "Evaluate or refine a technological solution that reduces impacts of human activities on natural systems. Clarification Statement: Examples of data on the impacts of human activities could include the quantities and types of pollutants released, changes to biomass and species diversity, or areal changes in land surface use (such as for urban development, agriculture and livestock, or surface mining). Examples for limiting future impacts could range from local efforts (such as reducing, reusing, and recycling resources) to large-scale geoengineering design solutions (such as altering global temperatures by making large changes to the atmosphere or ocean)."
HS-ESS3-5	Analyze geoscientific data and the results from global climate models to make an evidence-based forecast of the current rate of global or regional	**Keep as proposed.** This format is based upon the research-based three-dimensional structure for how students develop understanding in science.

	climate change and associated future impacts to Earth systems. [Clarification Statement: Examples of evidence, for both data and climate model outputs, are for climate changes (such as precipitation and temperature) and their associated impacts (such as on sea level, glacial ice volumes, or atmosphere and ocean composition).] [Assessment Boundary: Assessment is limited to one example of a climate change and its associated impacts.]	By embedding the content (disciplinary core idea) with the practices of science and overarching themes (cross-cutting concepts). This format is based upon decades of research which is compiled in A Framework for K-12 Science Education. The content was addressed in the previous GLEs but the standard has been updated based upon research on how students learn and understand science best. The new format also ensures the standard is not culturally biased but represents equity in science for all.
HS-ESS3-6	Predict how human activity affects the relationships between Earth systems in both positive and negative ways. [Clarification Statement: Examples of Earth systems to be considered are the hydrosphere, atmosphere, cryosphere, geosphere, and/or biosphere.]	This standard does not follow the same three-dimensional format as the others and it is very broad. Perhaps another way to word it would be as follows: "Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity. Clarification Statement: Examples of Earth systems to be considered are the hydrosphere, atmosphere, cryosphere, geosphere, and/or biosphere. An example of the far-reaching impacts from a human activity is how an increase in atmospheric carbon dioxide results in an increase in photosynthetic biomass on land and an increase in ocean acidification, with resulting impacts on sea organism health and marine populations.

		Assessment Boundary: Assessment does not include running computational representations but is limited to using the published results of scientific computational models.”

Physical Science Performance Expectations

Performance Expectation (PE) Coding for Proposed MLS	Proposed MLS Standard	Feedback
HS-PS1-1	Use the organization of the periodic table to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms. [Clarification Statement: Examples of properties that could be predicted from patterns could include reactivity of metals, types of bonds formed, numbers of bonds formed, and reactions with oxygen.] [Assessment Boundary: Assessment is limited to main group elements. Assessment does not include quantitative understanding of ionization energy beyond relative trends.]	The periodic table serves as a model since its organization allows for predictions in trends. The practice of modeling should somehow be noted to maintain the three-dimensional structure of the performance expectation.
HS-PS1-2	Construct and revise an explanation for the products of a simple chemical reaction based on the outermost electron states of atoms, trends in	**Keep as proposed.** This format is based upon the research-based three-dimensional structure for how students develop understanding in science. By

	the periodic table, and knowledge of the patterns of chemical properties. [Clarification Statement: Examples of chemical reactions could include the reaction of sodium and chlorine, or of oxygen and hydrogen.] [Assessment Boundary: Assessment is limited to chemical reactions involving main group elements including synthesis, decomposition, combustion, and/or replacement reactions.]	embedding the content (disciplinary core idea) with the practices of science and overarching themes (cross-cutting concepts). This format is based upon decades of research which is compiled in A Framework for K-12 Science Education. The content was addressed in the previous GLEs but the standard has been updated based upon research on how students learn and understand science best. The new format also ensures the standard is not culturally biased but represents equity in science for all.
HS-PS1-3	Plan and conduct an investigation to gather evidence to compare physical and chemical properties of substances such as melting point, boiling point, vapor pressure, surface tension, and chemical reactivity to infer the relative strength of attractive forces between particles. [Clarification Statement: Emphasis is on understanding the relative strengths of forces between particles. Examples of particles could include ions, atoms, molecules, and networked materials (such as graphite). [Assessment Boundary: Assessment does not include Raoult's law calculations of vapor pressure.]	This standard (HS-PS1-3) is verbose. The purpose of the clarification statement is to include the details and examples of what is meant by the standard. By putting some of those components in the standard, the flexibility for assessment is also affected. Perhaps simplify the standard and place the standard components in the clarification statement. "Plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles. [Clarification Statement: Emphasis is on understanding the strengths of forces between particles, not on naming specific intermolecular forces (such as dipole-dipole). Examples of particles could include ions, atoms, molecules, and networked materials (such as

		graphite). Examples of bulk properties of substances could include the melting point and boiling point, vapor pressure, and surface tension.] [Assessment Boundary: Assessment does not include Raoult's law calculations of vapor pressure.]
HS-PS1-4	Apply the concepts of bonding and crystalline/molecular structure to explain the macroscopic properties of various categories of structural materials, i.e. metals, ionic (ceramics), and polymers. [Clarification Statement: Emphasis is on the attractive and repulsive forces that determine the functioning of the material. Examples could include why electrically conductive materials are often made of metal, flexible but durable materials are made up of long chained molecules, and pharmaceuticals are designed to interact with specific receptors.] [Assessment Boundary: Assessment is limited to structures of specified materials.]	This standard (HS-PS1-4) actually clusters more appropriately with Motion and Stability: Forces and Interactions in terms of the attractive and repulsive forces. A topical cluster for structure and properties of matter would clarify the connections. This is certainly a standard that overlaps both Matter and Its Interactions and Forces and Interactions but since the focus is on bonding then it seems to fit more appropriately with Forces and Interactions.
HS-PS1-5	Develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy. [Clarification Statement: Emphasis is on the idea that a chemical reaction is a system that affects the energy change. Examples of models could include molecular-level drawings and diagrams of reactions, graphs showing the relative energies of reactants and products, and	**Keep as proposed.** This format is based upon the research-based three-dimensional structure for how students develop understanding in science. By embedding the content (disciplinary core idea) with the practices of science and overarching themes (cross-cutting concepts). This format is based upon decades of research which is compiled in A Framework for K-12 Science Education.

	representations showing energy is conserved.] [Assessment Boundary: Assessment does not include calculating the total bond energy changes during a chemical reaction from the bond energies of reactants and products.]	The content was addressed in the previous GLEs but the standard has been updated based upon research on how students learn and understand science best. The new format also ensures the standard is not culturally biased but represents equity in science for all.
HS-PS1-6	Apply scientific principles and evidence to provide an explanation about the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs. [Clarification Statement: Emphasis is on student reasoning that focuses on the number and energy of collisions between molecules.] [Assessment Boundary: Assessment is limited to simple reactions in which there are only two reactants; evidence from temperature, concentration, and rate data; and qualitative relationships between rate and temperature. No calculations.]	**Keep as proposed.** This format is based upon the research-based three-dimensional structure for how students develop understanding in science. By embedding the content (disciplinary core idea) with the practices of science and overarching themes (cross-cutting concepts). This format is based upon decades of research which is compiled in A Framework for K-12 Science Education. The content was addressed in the previous GLEs but the standard has been updated based upon research on how students learn and understand science best. The new format also ensures the standard is not culturally biased but represents equity in science for all.
HS-PS1-7	Refine the design of a chemical system by specifying a change in conditions that would alter the amount of products at equilibrium.* [Clarification Statement: Emphasis is on the application of Le Chatelier's Principle and on refining designs of chemical reaction systems, including descriptions of the connection between changes made at the macroscopic level and what happens at the molecular level. Examples of	**Keep as proposed.** This format is based upon the research-based three-dimensional structure for how students develop understanding in science. By embedding the content (disciplinary core idea) with the practices of science and overarching themes (cross-cutting concepts). This format is based upon decades of research which is compiled in A Framework for K-12 Science Education.

	designs could include different ways to increase product formation including adding reactants or removing products.] [Assessment Boundary: Assessment is limited to specifying the change in only one variable at a time. Assessment does not include calculating equilibrium constants and concentrations.]	The content was addressed in the previous GLEs but the standard has been updated based upon research on how students learn and understand science best. The new format also ensures the standard is not culturally biased but represents equity in science for all.
HS-PS1-8	Use symbolic representations and mathematical calculations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction. [Clarification Statement: Emphasis is on conservation of matter and mass through balanced chemical equations, use of the mole concept and proportional relationships.] [Assessment Boundary: Assessment does not include complex chemical reactions.]	A simplification of this standard would just state "Use mathematical representations to support . . ." A chemical reaction is a mathematical representation of proportions so it is simpler just to state the standard in that way. **Keep as proposed.** This format is based upon the research-based three-dimensional structure for how students develop understanding in science. By embedding the content (disciplinary core idea) with the practices of science and overarching themes (cross-cutting concepts). This format is based upon decades of research which is compiled in A Framework for K-12 Science Education. The content was addressed in the previous GLEs but the standard has been updated based upon research on how students learn and understand science best. The new format also ensures the standard is not culturally biased but represents equity in science for all.
HS-PS1-9	Use symbolic representations to illustrate the changes in the composition of the nucleus of the	Since the clarification statement specifically includes examples of types of models, the practice

	atom and the energy released during the processes of fission, fusion, and radioactive decay. [Clarification Statement: Emphasis is on simple qualitative models, such as pictures or diagrams, and on the scale of energy released in nuclear processes relative to other kinds of transformations.] [Assessment Boundary: Assessment does not include quantitative calculation of energy released. Assessment is limited to alpha, beta, and gamma radioactive decays.]	of modeling should be explicit in the standard. It could simply state, "Use and/or develop models . . ." rather than "Use symbolic representations." We must be explicit with the practices to convey some of the new understandings for these practices and for inquiry in general.
HS-PS2-1	Analyze data to support and verify the concepts expressed by Newton's 2nd law of motion, as it describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration. [Clarification Statement: Examples of data could include tables or graphs of position or velocity as a function of time for objects subject to a net unbalanced force, such as a falling object, an object rolling down a ramp, or a moving object being pulled by a constant force.] [Assessment Boundary: Assessment is limited to one-dimensional motion and to macroscopic objects moving at non-relativistic speeds.]	Wording could be simplified some but overall fine. **Keep as proposed.** This format is based upon the research-based three-dimensional structure for how students develop understanding in science. By embedding the content (disciplinary core idea) with the practices of science and overarching themes (cross-cutting concepts). This format is based upon decades of research which is compiled in A Framework for K-12 Science Education. The content was addressed in the previous GLEs but the standard has been updated based upon research on how students learn and understand science best. The new format also ensures the standard is not culturally biased but represents equity in science for all.
HS-PS2-2	Use mathematical representations to support and verify the concepts that the total momentum of a	**To emphasize the practice of argumentation at the high school level and continue the learning**

	system of objects is conserved when there is no net force on the system. [Clarification Statement: Emphasis is on the quantitative conservation of momentum in interactions and the qualitative meaning of this principle.] [Assessment Boundary: Assessment is limited to systems of two macroscopic bodies moving in one dimension.]	**progression for that practice as well as the content, it would be better to have students support "the claim" rather than "the concepts." The practices are college and career ready skills students need to learn and develop in addition to the content for the science discipline.** **Keep as proposed.** This format is based upon the research-based three-dimensional structure for how students develop understanding in science. By embedding the content (disciplinary core idea) with the practices of science and overarching themes (cross-cutting concepts). This format is based upon decades of research which is compiled in A Framework for K-12 Science Education. The content was addressed in the previous GLEs but the standard has been updated based upon research on how students learn and understand science best. The new format also ensures the standard is not culturally biased but represents equity in science for all.
HS-PS2-3	Apply scientific principles of motion and momentum to design, evaluate, and refine a device that minimizes the force on a macroscopic object during a collision.* [Clarification Statement: Examples of evaluation and refinement could include determining the success of the device at protecting an object from damage and modifying the design to	**Keep as proposed.** This format is based upon the research-based three-dimensional structure for how students develop understanding in science. By embedding the content (disciplinary core idea) with the practices of science and overarching themes (cross-cutting concepts). This format is based upon decades of research which is compiled in A

	improve it. Examples of a device could include a football helmet or a parachute.] [Assessment Boundary: Assessment is limited to qualitative evaluations and/or algebraic manipulations.]	Framework for K-12 Science Education. The content was addressed in the previous GLEs but the standard has been updated based upon research on how students learn and understand science best. The new format also ensures the standard is not culturally biased but represents equity in science for all.
HS-PS2-4	Use mathematical representations of Newton's Law of Gravitation to describe and predict the gravitational forces between objects. [Clarification Statement: Emphasis is on both quantitative and conceptual descriptions of gravitational fields.] [Assessment Boundary: Assessment is limited to systems with two objects.]	**Keep as proposed for physical science but districts using these standards for their chemistry and physics courses would also need to incorporate Coulomb's Law and electrostatic forces between objects.** Perhaps the standard could read: "Use mathematical representations of Newton's Law of Gravitation and Coulomb's Law to describe and predict the gravitational and electrostatic forces between objects." This format is based upon the research-based three-dimensional structure for how students develop understanding in science. By embedding the content (disciplinary core idea) with the practices of science and overarching themes (cross-cutting concepts). This format is based upon decades of research which is compiled in A Framework for K-12 Science Education. The content was addressed in the previous GLEs but the standard has been updated based upon

		research on how students learn and understand science best. The new format also ensures the standard is not culturally biased but represents equity in science for all.
HS-PS2-5	Plan and conduct an investigation to provide evidence that an electric current can produce a magnetic field and that a changing magnetic field can produce an electric current. [Assessment Boundary: Assessment is limited to designing and conducting investigations with provided materials and tools.]	**Keep as proposed.** This format is based upon the research-based three-dimensional structure for how students develop understanding in science. By embedding the content (disciplinary core idea) with the practices of science and overarching themes (cross-cutting concepts). This format is based upon decades of research which is compiled in A Framework for K-12 Science Education. The content was addressed in the previous GLEs but the standard has been updated based upon research on how students learn and understand science best. The new format also ensures the standard is not culturally biased but represents equity in science for all.
HS-PS3-1	Create a computational model to calculate the change in the energy of one component in a system when the changes in energy are known. [Clarification Statement: Emphasis is on explaining the meaning of mathematical expressions used in the model.] [Assessment Boundary: Assessment is limited to basic algebraic expressions or computations; to systems of two or three components; and to thermal energy, kinetic energy, and/or the energies in gravitational, magnetic, or electric fields.]	**Keep as proposed.** This format is based upon the research-based three-dimensional structure for how students develop understanding in science. By embedding the content (disciplinary core idea) with the practices of science and overarching themes (cross-cutting concepts). This format is based upon decades of research which is compiled in A Framework for K-12 Science Education. The content was addressed in the previous GLEs but the standard has been updated based upon

		research on how students learn and understand science best. The new format also ensures the standard is not culturally biased but represents equity in science for all.
HS-PS3-2	Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motions of particles (objects) and energy associated with the relative position of particles (objects). [Clarification Statement: Examples of phenomena at the macroscopic scale could include the conversion of kinetic energy to thermal energy, the energy stored due to position of an object above the earth, and the energy stored between two electrically-charged plates. Examples of models could include diagrams, drawings, descriptions, and computer simulations.]	**Keep as proposed.** This format is based upon the research-based three-dimensional structure for how students develop understanding in science. By embedding the content (disciplinary core idea) with the practices of science and overarching themes (cross-cutting concepts). This format is based upon decades of research which is compiled in A Framework for K-12 Science Education. The content was addressed in the previous GLEs but the standard has been updated based upon research on how students learn and understand science best. The new format also ensures the standard is not culturally biased but represents equity in science for all.
HS-PS3-3	Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy.* [Clarification Statement: Emphasis is on both qualitative and quantitative evaluations of devices. Examples of devices could include Rube Goldberg devices, wind turbines, solar cells, solar ovens, and generators. Examples of constraints could include use of renewable energy forms and efficiency.] [Assessment Boundary: Assessment for quantitative evaluations is limited to total output for a given input.	**Keep as proposed.** This format is based upon the research-based three-dimensional structure for how students develop understanding in science. By embedding the content (disciplinary core idea) with the practices of science and overarching themes (cross-cutting concepts). This format is based upon decades of research which is compiled in A Framework for K-12 Science Education. The content was addressed in the previous GLEs but the standard has been updated based upon

	Assessment is limited to devices constructed with materials provided to students.]	research on how students learn and understand science best. The new format also ensures the standard is not culturally biased but represents equity in science for all.
HS-PS3-4	Plan and conduct an investigation to provide evidence that the transfer of thermal energy when two components of different temperature are combined within a closed system results in a more uniform energy distribution among the components in the system (second law of thermodynamics). [Clarification Statement: Emphasis is on analyzing data from student investigations and using mathematical thinking to describe the energy changes both quantitatively and conceptually. Examples of investigations could include mixing liquids at different initial temperatures or adding objects at different temperatures to water.] [Assessment Boundary: Assessment is limited to investigations based on materials and tools provided to students.]	**Keep as proposed.** This format is based upon the research-based three-dimensional structure for how students develop understanding in science. By embedding the content (disciplinary core idea) with the practices of science and overarching themes (cross-cutting concepts). This format is based upon decades of research which is compiled in A Framework for K-12 Science Education. The content was addressed in the previous GLEs but the standard has been updated based upon research on how students learn and understand science best. The new format also ensures the standard is not culturally biased but represents equity in science for all.
HS-PS3-5	Develop and use a model of two objects interacting through electric or magnetic fields to illustrate the forces between objects and the changes in energy of the objects due to the interaction. [Clarification Statement: Examples of models could include drawings, diagrams, and texts, such as drawings of what happens when two charges of opposite polarity are near each other.] [Assessment Boundary: Assessment is limited to systems containing two objects.]	**Keep as proposed.** This format is based upon the research-based three-dimensional structure for how students develop understanding in science. By embedding the content (disciplinary core idea) with the practices of science and overarching themes (cross-cutting concepts). This format is based upon decades of research which is compiled in A Framework for K-12 Science Education. The content was addressed in the previous GLEs

		but the standard has been updated based upon research on how students learn and understand science best. The new format also ensures the standard is not culturally biased but represents equity in science for all.
HS-PS4-1	Use mathematical representations to support a claim regarding relationships among the frequency, wavelength, and speed of waves traveling in various media. [Clarification Statement: Examples of data could include electromagnetic radiation traveling in a vacuum and glass, sound waves traveling through air and water, and seismic waves traveling through the Earth.] [Assessment Boundary: Assessment is limited to algebraic relationships and describing those relationships qualitatively.]	**Keep as proposed.** This format is based upon the research-based three-dimensional structure for how students develop understanding in science. By embedding the content (disciplinary core idea) with the practices of science and overarching themes (cross-cutting concepts). This format is based upon decades of research which is compiled in A Framework for K-12 Science Education. The content was addressed in the previous GLEs but the standard has been updated based upon research on how students learn and understand science best. The new format also ensures the standard is not culturally biased but represents equity in science for all.
HS-PS4-2	Evaluate the claims, evidence, and reasoning behind the idea that electromagnetic radiation can be described either by a wave model or a particle model, and that for some situations one model is more useful than the other. [Clarification Statement: Emphasis is on how the experimental evidence supports the claim and how a theory is generally modified in light of new evidence. Examples of a phenomenon could include resonance, interference, diffraction, and	**Keep as proposed.** This format is based upon the research-based three-dimensional structure for how students develop understanding in science. By embedding the content (disciplinary core idea) with the practices of science and overarching themes (cross-cutting concepts). This format is based upon decades of research which is compiled in A Framework for K-12 Science Education. The content was addressed in the previous GLEs

	photoelectric effect.] [Assessment Boundary: Assessment does not include using quantum theory.]	but the standard has been updated based upon research on how students learn and understand science best. The new format also ensures the standard is not culturally biased but represents equity in science for all.
HS-PS4-3	Communicate technical information about how electromagnetic radiation interacts with matter. [Clarification Statement: Examples could include solar cells capturing light and converting it to electricity; medical imaging; and communications technology.] [Assessment Boundary: Assessments are limited to qualitative information. Assessments do not include band theory.]	HS-PS4-3 is oversimplified and could even lead to a misconception. The wording listed below represents what students should know, understand and do much better in the three-dimensional format. Communicate technical information about about how some technological devices use the principles of wave behavior and wave interactions with matter to transmit and capture information and energy. [Clarification Statement: Examples could include solar cells capturing light and converting it to electricity; medical imaging; and communications technology.] [Assessment Boundary: Assessments are limited to qualitative information. Assessments do not include band theory.]
HS-PS4-4	Evaluate the validity and reliability of claims in published materials of the effects that different frequencies of electromagnetic radiation have when absorbed by matter. [Clarification Statement: Emphasis is on the idea that photons associated with different frequencies of light have different energies, and the damage to living tissue from electromagnetic radiation depends on the energy of the radiation. Examples of published materials	**Keep as proposed.** This format is based upon the research-based three-dimensional structure for how students develop understanding in science. By embedding the content (disciplinary core idea) with the practices of science and overarching themes (cross-cutting concepts). This format is based upon decades of research which is compiled in A Framework for K-12 Science Education.

	could include trade books, magazines, web resources, videos, and other passages that may reflect bias.] [Assessment Boundary: Assessment is limited to qualitative descriptions.]	The content was addressed in the previous GLEs but the standard has been updated based upon research on how students learn and understand science best. The new format also ensures the standard is not culturally biased but represents equity in science for all.
		There is a need for a standard that will allow students to learn about digital versus analog methods of transmission and storage of information. Advancements in technology necessitate the addition of a standard so students actually explore and evaluate the benefits of the technologies we use each and every day. Although this is not a concept that has been taught in the past, our knowledge has advanced and students should evaluate and investigate "Evaluate questions about the advantages of using a digital transmission and storage of information"

From:	Kuntz, Lisa
To:	1490Comments; Julie Esquivel; Reger, Tricia; Angela Meintz; Lisa Kuntz; Debbie Lechner
Subject:	2nd grade Science Curriculum Feedback
Date:	Monday, November 30, 2015 9:23:19 AM

After reviewing the proposed Science Standards for Missouri, I have the following comments

- Physical Science:
  - 2-PS1-A (Structure and Properties of Matter) - no concerns
  - 2-PS1-B (Types of Interactions of Matter) - new to us, but OK to keep
  - 2-PS1-3 we see as a supporting strand and feel it may become overlooked when developing curriculum.
  - 2-PS1-4 We support the elimination of this concept for 2nd grade (We feel it is difficult for a 2nd grader to distinguish between physical and chemical changes.)
  - 2-PS2-A and 2-PS4-A - We have noticed these concepts are touched on in every grade level. We feel that it will be more difficult for students to retain the concepts if they are briefly touched on each year vs. being taught in depth at a specific grade level. (i.e. teach a sound unit in 1st grade where it has been taught previously) Depth vs. breadth issue
- Earth Science
  - noticed no changes and we support that these concepts are appropriate for 2nd graders
- Life Science
  - LS2-A Interdependent Relationships in Ecosystems - noticed no changes and we support that these concepts are appropriate for 2nd graders
  - LS1-A Structure and Function - we feel this would be better taught within the context of habitats like the NGSS 2-LS4-1 originally suggested. Students would have a better context within which to make connections.

Thank you for your considering our input as educators in the classroom,
Lisa Kuntz (14 years of service), Angela Meintz (11 years of service), Debbie Lechner (41 year of service)

From:	1490Comments
To:	1490Comments
Subject:	FW: Liberty Public Schools Teacher Feedback on HB1490 Proposals
Date:	Wednesday, December 09, 2015 12:26:41 PM
Attachments:	LPS HB1490 Feedback Nov 2015.docx

From: Jeanette Westfall [mailto:jwestfall@liberty.k12.mo.us]
Sent: Tuesday, November 24, 2015 1:43 PM
To: 1490Comments
Subject: Liberty Public Schools Teacher Feedback on HB1490 Proposals

To Whom It May Concern:

Thank you for considering Liberty teacher input in your curriculum review and alignment next steps. We will also send this submission as certified mail with the USPS.

With respect,

Dr. Jeanette Westfall
Director of Curriculum, Instruction & Staff Development
Liberty 53 School District
8 Victory Lane
Liberty, MO 64068
(816) 736-5320

Inspire. Invest. Innovate.

Date: December 20, 2015

To: Missouri State Board of Education

Liberty Public Schools has worked collaboratively in grade level and content area teacher teams to review the HB1490 Work Groups submissions. We appreciate the opportunity to offer our feedback to the continued work on the K-12 curriculum standards.

Our teachers, staff, and community members have been encouraged to submit input on-line, but many of our instructional staff also felt the need to submit additional information as a collective. Their feedback and input is included with this letter.

Thank you for listening to our teachers and including their thinking in the next iteration of the curriculum to be presented to the Board of Education. We would be honored for you to consider our work. Additionally, if DESE creates any additional teacher work groups to refine the input from stakeholders, Liberty teachers are eager to help. Please let us know if we can be of any assistance.

With deep respect,

/s/ *Jeanette Westfall*

Jeanette Westfall, EdD
Director of Curriculum, Instruction & Staff Development
Liberty Public Schools #53

Dr. Jeanette Westfall
8 Victory Lane, Liberty, MO 64068
Phone: 816.736.6486 E-Mail: jwestfall@liberty.k12.mo.us

Liberty Public Schools #53
Instructional Staff Feedback by Content

High School Science:
The level of rigor and organization of the proposed standards (Grades 6 – 12) is significantly improved from the science standards previously adopted by DESE. Whereas the current standards are very knowledge-based, the proposed standards require that students apply higher-level thinking in science coursework. The three-dimensional learning practices that form the basis of the middle and high school standards will cause a shift in thinking among educators. This should significantly improve science education in the state of Missouri and will serve to prepare our students for the future, as this design integrates Disciplinary Core Ideas, Cross-Cutting Concepts, and Science & Engineering Practices into a cohesive structure for science instruction.

One example of an improvement in the standards is the requirement that students "…apply concepts of statistics and probability…" As this is an essential skill in scientific thinking, it is very impressive to see this overtly stated in the proposed standards. For too long, we have considered some science courses as requiring "no math" when mathematical concepts are essential to ALL areas of science. Other standards include the phrase "construct an argument based on evidence…" which is another critical scientific literacy skill. Constructing arguments and applying mathematical concepts will lead to higher levels of performance by all students. Further, it is anticipated that the proposed standards will also allow more students across the state to have an authentic laboratory experience in which they have opportunities to collect, analyze and report data. The organization of the new Missouri Learning Standards will require the integration of science practices throughout the course.

In an effort to provide the most comprehensive and cohesive model for science instruction in Missouri, it is suggested that the proposed elementary science standards receive additional review by educators to ensure that they work in tandem with the proposed middle and secondary standards to provide for thorough and rigorous science education for Missouri students. We believe the committee has made a good start with the elementary standards but that they need some reorganization to meet the needs of students.

High School Social Studies: There are slight concerns over some of the testing implications due to the increased vagueness in the proposed standards for government. There is also a clear shift away from economics and a change in emphasis on the philosophers that influenced the development of constitutional governments that I don't quite understand the reason for.

In world history, there is more of an emphasis on world history as opposed to European history, which I think is a good change. It is odd, however, why they choose to specifically focus on civilizations like the Gupta but then vaguely address East Asia and the Islamic Empires.

Government:
Theme 1 Strand 4: want to make sure we are talking about "opportunity costs" and benefits, not "costs" and benefits. Can be a little confusing
Theme 2 Strand 2: might want to add primary sources for Enlightenment Thinkers on Social Contract. Hobbes, Montesquieu, Locke, & Rousseau were heavily featured before. Not sure why the shift away from them.
Theme 3: mentions "Seminal Supreme Court Cases" for primary sources they would recommend. Would like to know which cases the state feels are seminal.
US History:
Theme 6: there is a concern that the history is too new to effectively "analyze" or "evaluate" and that lower levels of Bloom's Taxonomy should dominate this theme
General questions:
Why aren't Essential Questions provided by the state to guide instruction?
Possible primary and secondary sources: are these merely suggestions or are they tied to EOCs (particularly Government since this is the only one currently tested)? In other words, are those documents referenced in state tests?

High School Mathematics:

Algebra 1

Standard: A1.IF.C.7- Graph functions, including simple piecewise defined functions (linear, simple quadratic and simple exponential), from their symbolic representation and show key features of the graph both by hand and by using technology.
Proposed change: Omit piecewise functions, or change to interpreting given piecewise functions (not graphing)
Rationale: Time would be better spent focusing on a deep understanding of the three types of functions. This is covered in upper level courses, and is very conceptually difficult for what is typically a freshmen level class.

Standard: All of Data and Statistical Analysis Domain
Proposed change: Significantly reduced or omitted from this course. (Keep scatterplots with linear relationships)
Rationale: Student have calculated measure of central tendency and represented data in different graphical representations in previous grades. Determining residuals from lines of fit, relative frequencies, and in depth analysis are far above what an average citizen would need to know to be able to make informed decisions, and several of these items are covered in Algebra 2. Putting so much focus on this unit uses considerable time that would be better spent on developing a deep understanding of Algebra, which is key for success in any future course.

Standard: A1.REI.C.9def- Solve mathematical and real-world problems involving quadratic equations in one variable. (methods: completing the square, quadratic formula, square roots, factoring; derive quadratic formula).
Proposed change: Omit completing the square, focus on solving by factoring and only simple quadratics (ax^2 + c = 0) for solving.
Rationale: There is simply not enough time to realistically cover everything listed in the school year. Quadratics are covered extensively in Algebra 2. An introduction to basics is all that is necessary and feasible in Algebra 1. Derivation of the quadratic formula is very difficult, even for upper level students, and is too overwhelming for freshmen or younger students!

Geometry

Standard: G.SRT.A.1a - Verify experimentally the properties of dilations given by a center and scale factor: A dilation takes a line not passing through the center of the dilation to a parallel line, and leaves a line passing through the center unchanged.
Proposed change: Omit
Rationale: A minute detail that does not impact students' understanding of properties of dilations given by a center and a scale factor.

Standard: Probability Domain
Proposed change: Omit
Rationale: It is typically covered in Algebra II. Not enough time to get to this before testing.

Standard: G.S.RT.B.4 Prove theorems about triangles. (Theorems should include: a line parallel to one side of a triangle divides the other two side proportionally, and conversely, the Pythagorean Theorem proved using triangle similarity.
Proposed change: change prove theorems to use theorems
Rationale: It is more important to be able to use the concept correctly than spend time proving it.

Algebra 2

Standard: A2.APR.A.4 - Understand the Remainder Theorem: For a polynomial *p(x)* and a number *a,* the remainder on division of *p(x)* by *(x-a)* is *p(a)*, so *p(a) = 0* if and only if *(x-a)* is a factor of *p(x)*.
Proposed Change: Omit
Rationale: This is typically covered in Precalculus and College Algebra courses

Standards: Data and Statistical Analysis Domain
Proposed Change: Omit
Rationale: If the state test for juniors is going to be the ACT, data analysis and statistics are not tested on the ACT. As Algebra 2 is a course taken predominantly by juniors, we feel other standards should be considered, such as sequences and series and trigonometry. Sequences and patterns are commonly seen on the ACT, as well as simple trigonometry and Law of Sines and Law of Cosines. The Law of Sines and Law of Cosines are not included in the Geometry standards, but are tested on the ACT.

Standards: Review of Trigonometry, specifically addressing Law of Sines and Law of Cosines
Proposed Change: Add
Rationale: See above regarding the ACT Test. Copy and paste as necessary.

Standards: Sequences and Patterns
Proposed Change: Add
Rationale: See above regarding the ACT Test. Copy and paste as necessary.

Middle School Social Studies

Grade Levels Taught	Standards to Address	Proposed Changes
6th	The current standards that we address are what students are capable of grasping and understanding especially when 6th grade is really the first year they are exposed to concentrated social studies class.	At present the students level of engagement is high because of the standards and present curriculum that we teach.
6th		Word History Theme 1 = 6th through 8th World History Theme 2 and 3 = 6th World History Theme 4 = 7th Geography = 6th through 8th
6th/7th	We would like to see more an emphasis on the World Geography Standards. We would also like to see the standards that correlate Japan, Mayans, Incan, African Empires emphasized in the curriculum.	We would like to see the World Geography standards incorporated with the World History standards.
6th/8th	MS World History Theme 1- all social studies classes Themes 2-3 = 6th Grade Themes 4-5 = 7th Grade MS Geography Themes 1-2 - all social studies classes MS American History - all themes = 8th grade	The MS World History course expectations are not realistic for a one year course. Many of the geography standards are integrated into history expectations. Split World History into 2 courses and integrate geography.
7th	Geography is substantially shorter than other strands. Is there a recommended timeline? Could Geography be blended in with the world and US history?	
7th	The World History Theme 1 and 2 standards need to be merged with the Geography Theme 1 and 2 standards as they are repetitive and should be combined.	I would like to see middle school world history and geography course expectations combined as the 6th and 7th grade courses are set up now. Having worked at another local district that did not combine the geography and world history course expectations, I observed the students only received an education on ancient Greece and Egypt.

Middle School Mathematics:

After having some good discussion about this yesterday at our meeting, the teachers said that there was nothing that they thought needed to be changed and they actually liked some of the new wording in the standards better.

Middle School Science:

Praise:

- We appreciate the level of quality resources used to create these standards.
- We appreciate that performance expectations from A Framework for K-12 Science Education as that brings the standards from a DOK 1 and 2 to a more appropriate DOK 3 and 4.
- We noticed and appreciate that amount of content has been shortened while deepening the content that was kept.
- We are excited that the standards now include multiple opportunities to tie in engineering, technology, and relevant careers.

Concerns:

- It is felt that the STATE will need to delineate where each learning standard is taught to ensure that transient students have a consistent education when moving rather than leaving it up to each district which standards should be taught at each grade. We are concerned that the standards do not currently include grade level delineation. Thinking about the ability of 11-14 year old children to cognitively grasp abstract concepts and then further analyze and apply, there are DOK expectations included in the standards that are clearly better aligned to 8th graders rather than 6th graders. We would encourage the committee not to take a "one size fits all" approach children in 6th–8th grades as the standards are currently presented. This will also help transient students to have a consistent experience at any Missouri school and not miss/repeat content.
- Amount of time to get through standards
- Amount of background knowledge to even address goal

MS Science Standard-by-Standard Feedback:

- MSPS1-1. Develop models to describe the atomic composition of simple molecules and extended structures. (Organic chemistry, too high???)
- MSLS1-3. Develop an argument supported by evidence for how multicellular organisms are organized by varying levels of complexity; cells, tissue, organs, organ systems. (How can this be augmented?)
- MSLS4-4. Interpret graphical representations to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time. (Will data be provided to support teachers in teaching standards that required data to teach?)
- The word "model" implies a physical model. This either needs to be reworded or clarified to ensure teachers don't go back to "cakes of cell models" as this does not teach a standard that asked to compare/contrast organelles.
- MS-PS3-1- The clarification statement does not clarify. It is very confusing!
- MS-PE3-3 How will this as assessed on a state level test?
- MS-PS3-4 and 5 I do not think these are 7th grade level questions. These are asking for some pretty high level thinking and implying lots of background knowledge in order to get to this high level.

- MS-ESS1-1 In the clarification it talks about models can be "physical, graphical or conceptual" how does that clarify anything? Perhaps it should define if the model is merely to reproduce the system or is the goal to explain the relationship between the Earth, Sun and Moon?
- MS-ESS1-2 Same as above.
- MS-ESS1-4 Is it really necessary to have this objective? Seems a bit out of place.
- MS-ESS1-5 I don't think this fits at all with this thread. This is more geologic history and fossil evidence. Having this objective here leads me to think we are to talk about the formation of the universe which unless you have super current information (not text book) you will be wrong and teaching vastly outdated material. If the intention is to teach the Big Bang or other widely accepted and scientifically backed theories of the formation of the universe then that needs to be stated. Personally, I'm ok with it because having those conversations allows students to see that science is constantly evolving and hopefully this realization would eliminate the "science keeps changing their mind" thought.
- We question why the current Missouri Learning Standards for human body systems has been deleted. The Missouri state Health standards do not address some of the process introductions needed for students to be successful in biology. Specific examples include the process of nutrients passing through a semi-permeable membrane of a cell and the cell's ability to turn that into energy.
- We are wondering if leaving out specific references to scientists of the past (I.e. Newton) was intentional and if so – why? We think that starting with a historical perspective gives students insight into the discoveries of these scientific laws and theories

Elementary Social Studies:

Kindergarten

(Not in proposed standards) PPG.2.A Participate in a democratic decision making processes. *I think it would be good for kids to have a chance to practice/learn what it means to vote. We do this every year on Election Day.

H.3.B.K.b Compare your family in the past and present. * I don't think kindergarteners have enough life perspective to do this.

The following are all new to K-I'm not sure K's have enough life perspective for the depth of these! Not developmentally appropriate standards for 5-6 year olds in my opinion.
RI.6.A.K Describe cultural characteristics of your family and class members (e.g., language, celebrations, customs, holidays, artistic expression, food, dress, & traditions).
Ideas and beliefs of different cultures
RI.6.C.K Share stories related to your family cultural traditions and family lore. Cultural heritage and preservation
RI.6.D.4 Describe how you and your family remember and commemorate your cultural heritage.
the world?

First Grade
During 4th qtr. writer's workshop, 1st graders are supposed to write non-fiction pieces. They are no longer covering famous Americans during social studies in a way that is integrated between academic subjects. The famous Americans covered according the standards are related to holidays. This significantly decreases the number of famous Americans taught and therefore limits the number of famous Americans researched and written about.

We feel comfortable with the other items listed.

Second Grade
Geographical Study
EG.5.A.2.a. Read and construct maps with title and key (regions of state, U.S., world)
I feel that at our level, being able to construct a map with title and key is developmentally appropriate. I think maybe being able to locate our state on a map is okay, but not sure on details of the world?

ES 5.B.2.a Name and locate regions of the world (continents, oceans, hemispheres) I think having students locate and name oceans and continents and not hemispheres.

I really think understanding relationships between and among regions is a little over 2nd grade. Maybe focusing in on Missouri alone and then able to build on it to compare regions in 3rd grade?

I think they have added a lot to what we already do and some seem to overlap as well.

Fourth Grade
Agree
GOVERNMENT
Functions of governmental systems makes sense (state to federal and then to compare)

HISTORY
K - George Washington, Abe Lincoln
1st - MLK, Thomas Jefferson, Christopher Columbus
2nd - Inventors or Pioneers
3rd - Famous Missourians
4th - Significant individuals of 1800
5th - Significant individuals
1800-1940

ECONOMICS
Stayed the same

GEOGRAPHY
matches the government

CULTURE STUDY
New, but agree

SOCIAL SCIENCE INQUIRY
Same

Questionable

HISTORY

Civil War is introduced in third (gained 4th grades exact standard) then built in 5th. ?Why is this skipping 4th?

Why are the standards in history not introduced in chronological order?
Example, goes from Civil War(3rd), American Rev.(4th), back to Civil War(5th)

Student won't see the connections between time periods of time because events are taught out of chronological order
*Concerned with topics being taught out of chronological order

Why do our history standards stop at 1940

Suggestion - Organize history standards chronologically

GEOGRAPHY

State level to national level

Elementary ELA:

Writing Standards

Grade	Standard	Proposed Change (addition, deletion, modification in language, level or alignment)	Rationale for Change
5	Writing 1Db	Change two pages to one page.	Time doesn't allow for students to publish two pages. Very few pieces of our writing exceed five paragraphs.
5	Writing 3An	Bibliography - delete this	Intro/practice occurs with LMS; not age appropriate in classroom when the students are citing in their text.
5	Language 1Ab	Parts of speech - move to younger grade	Identify and use noun, pronoun, verb, adjective and adverb should occur earlier in elementary school
5	Language 1Bi	Apostrophes	Where did this previously occur?

Language Standards:

K	1Da	Give examples of digital tools	This would be helpful.
	1Bf	Use "reads" instead of "recognize" how to understand	The word recognize could cause confusion--what does it mean (spelling, reading, etc)
	1Bf	Use "reads" instead of "recognize" how to understand	The word recognize could cause confusion--what does it mean

Elementary Science:

Kindergarten feedback:
PS2B Observe that magnets cause some objects to move without touching them.
Recommendation: Move to 3rd grade
PS4A Compare and Contrast different sounds
Identify sounds and their source of vibration in everyday life.
Identify the ear as a receiver of vibrations that produce sounds.
Recommendation: Move to 1st grade

First Grade feedback:
PS3A Compare the temperature of hot and cold objects using a simple thermometer.
PS3B Identify sources of thermal energy
PS4B Identify the source of energy causes an increase in temperature of an object.
Recommendations: Move to 2nd grade

Second Grade feedback:
PS4-A Plan and conduct investigations to provide evidence that changes in vibration create change in sound.
Demonstrate that vibrating materials can create sounds and that sound can make materials vibrate.
Describe how the ear serves as a receiver of sounds.
Identify air, water and solids as media that sound travels through.
Recommendations: Move to 1st grade

Third Grade feedback:
ESS1B Explain how the sun's position in the sky and the Earth's rotation affect the length and direction of shadows.
Observe and identify the moon is visible because it reflect light.
Describe how the sun, moon and stars appears to move slowly across the sky from east to west during the day and/or night due to the rotations of the Earth
Explain that the changing shape of the moon during positions of the earth, moon and sun rather than due to the Earth's shadow falling on the moon.
Identify the three things (light source, object and surface) necessary to produce a shadow.
Identify the Earth rotates on its axis once every 24 hours.
Recommendation: Move to 1st grade
PS1B Construct an argument with evidence that some changes caused by heating or cooling can be reversed and some cannot.
PS3B Identify sources of thermal energy (sun, stove, tire, body) that can cause solids to change to liquids and liquids to change to gas.
Recommendation: Move to 2nd grade

Fourth Grade feedback:
PS2A Make observation and or measurement of an objects motion to provide evidence that a pattern can be used to predict future motion
Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object.
Recommendation: Move to third grade
PS2B Predict how changes in either the amount of force applied to an object or the mass of the object affects the motion (speed and direction) of the object
Observe the balanced forces do not affect an object's motion
Describe how unbalanced forces acting on an object changes its speed (faster/slower), direction of motion, or both.
Recommendation: Move to third grade

Fifth Grade feedback:
No change recommendations

From:	Cynthia McIlroy
To:	1490Comments
Cc:	Carol A. Neely
Subject:	Learning Standards review
Date:	Thursday, November 19, 2015 8:21:06 AM
Attachments:	image001.png AVG Certification.txt

Dear Sirs;

As an overall review I find the wording and standards to be too vague and open ended! Teachers need standards that are content specific, and that do not leave us guessing on what to teach.

Also, the language is so word driven that it leaves interpretation impossible!

ETS1.C: Too vague and wording is impossible

ETS1.A: " "

ETS1.B Too vague

LS2.A: What are the expectations, too vague

ESS3.A: & ESS3.B: Wording is impossible, need clear expectations

CYNTHIA M. MCILROY
MSTA REPRESENTATIVE
8TH GRADE SCIENCE
417-875-5476

What ever the mind of man can conceive and believe.....he can achieve!

"Success is to be measured not so much by the position that one has reached in life as by the obstacles which he has overcome"


• LEVEL 2 •
NIXA
TECH ACADEMY

From:	Weaver, Kimberly
To:	1490Comments
Subject:	Comments on proposed Science Standards
Date:	Wednesday, November 18, 2015 10:15:38 AM

My comments on the proposed K-12 Science standards are as follows:

I applaud the decision to base the standards on the Next Generation Science Standards. Particularly at the 6-12 grade bands, it is good to see close agreement between NGSS and the proposed Missouri Standards. However, in the K-5 bands, there is not as much agreement. **I would like to see Missouri adopt the full, complete, and exact set of NGSS standards** as is, rather than believing that we can "do better" than the hundreds of experts who put together the NGSS. Adopting the NGSS standards with no changes will also create a clearer environment for teachers and curriculum developers. Experts in other states are already creating materials aligned with NGSS.

If the decision is made to NOT use the NGSS exactly, then I would urge you to consider using a different numbering/naming system than the NGSS. If you keep the numbering system the same, it will be extremely confusing to educators. For example, the NGSS Standard MS-LS1-5 is called MS-LS1-6 in the proposed standards. Missouri should adopt a new naming/numbering system so that it is readily apparent to all that they are looking at an NGSS standard or a Missouri standard. **Of course, a better solution would be to adopt the NGSS as is.**

However, one way that the proposed Missouri standards deviate significantly from the NGSS standards is the removal of the Engineering standards for K-12. These standards in the NGSS are critical to preparing students to be creative, problem-solving employees of tomorrow. The engineering standards (provided in the NGSS in bands K-2, 3-5, 6-8, and 9-12) can be incorporated with science content and bring more relevance and meaning to the science classroom. These standards are also at the heart of the "3-dimensional learning" that is central to the NGSS. The Science and Engineering Practices and Crosscutting Concepts that are included in the 6-12 proposed standards (modeled after the NGSS) are directly applicable to the engineering standards, but don't make much sense without the inclusion of engineering standards. **I strongly urge you to reconsider restoring engineering standards standards.**

Overall, my comments can be summarized as follows: **I recommend that Missouri adopt the full and complete K-12 Next Generation Science Standards, which include standards for engineering.**

Respectfully,

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Kimberly Weaver
Engineering Educator
Institute for School Partnership
http://schoolpartnership.wustl.edu
Washington University
314-935-8138
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From: Tammy Robinett
To: 1490Comments
Subject: Science Standards Review
Date: Tuesday, November 10, 2015 1:22:31 PM

Upon review of the proposed Science Standards for 5th grade, I have a couple of very strong opinions. I feel 5th grade is an overloaded grade anyway because it is the first year science is tested. As a 9 year veteran science teacher, I find that I have to teach my standards, as well as standards that are not covered in lower grades because of the huge emphasis on Math and ELA. With that being said, I feel the addition of the Physical Science strand to fifth grade is unrealistic. The Inquiry strand might be gone, but it is really just interwoven throughout the other standards.

I feel most of the other standards are very similar to what we already have. The only other question I had was if we could get clarification on the new terms that are being used. For example, how would "obtaining and combining information" look?

Thanks for the opportunity to voice my opinion.

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Tammy Robinett
5th Grade Science Teacher
Doniphan Middle School

From:	1490Comments
To:	1490Comments
Subject:	FW: proposed standards- science
Date:	Wednesday, December 09, 2015 11:20:30 AM

From: Betsy Donnell [mailto:bdonnell@doniphanr1.k12.mo.us]
Sent: Wednesday, November 04, 2015 9:41 AM
To: 1490Comments
Subject: proposed standards

I feel like our language and math standards for 4th grade seem like exactly what we need. I like how specific each standard is and how they are laid out. The math standards also seem reasonable for the age group, and are laid out in a very user friendly manner. I am extremely concerned with the lack of science standards for fourth grade, and the shift in grade level for the standards in Social Studies. I feel the concepts that they are planning on teaching for 4th grade in civics are far too advanced. I understand the need to have a little more contemporary history at the elementary level for 5th grade. However, if a shift is made in standards from one grade to the lower grade the subject matter could change without the objectives themselves being too advanced.
Sincerely,
Betsy Donnell

From: Kyle Morse
To: 1490Comments
Subject: Science Standards
Date: Tuesday, October 27, 2015 11:02:24 AM

Why can't we just use NGSS? Seems like a waste of time and money to create these "new standards". NGSS are the highest quality standards for improving learning in the science classroom and developing skills that students can apply to any career path they choose. What is the indication that these standards, which have not been given input by SCIENCE EDUCATORS, will be better than anything else already. NGSS was created by SCIENCE EDUCATORS and really makes a lot of sense.

-Kyle Morse

From: Keller, Brian J.
To: 1490Comments
Subject: MO Standards for Science
Date: Monday, October 26, 2015 2:05:10 PM

First I would like to commend the work being done to provide new, updated standards to science and the fact that NGSS was used as a guide to getting this accomplished. I have one suggested amendment to the standards that must be a part of the new standards. The fact that the engineering standards have been completely removed scares me and it will not serve the students of Missouri favorably. Part of the curriculum that I incorporate in my classroom ties directly to engineering and the idea that students are allowed/encouraged to design and build their own solutions to real world problems. Connecting the science standards to engineering is an essential part of real world problems solving. Engineers of any kind are in high demand and the elimination of these standards would do a disservice to our students as we look to prepare them for 21st century jobs.

Brian Keller
5th Grade Teacher
Mallinckrodt Academy
Saint Louis, Missouri

“Creativity is thinking up new things. Innovation is doing new things.”
— Theodore Levitt

From: Matt Pearce
To: 1490Comments
Subject: k-5 Science Standards
Date: Monday, October 26, 2015 11:27:55 AM

I am wondering how these are different from the Grade Level Expectations? It does not seem to me that we have narrowed our focus and we are continuing down the path of information and coverage. I know this is late in the game, but I would like to see more of a focus on essential learning versus coverage of everything.

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Matt Pearce
Assistant Superintendent Academic Services
@mpearce62
518 N. Hampton
Republic, Missouri 65738
417-732-3605

From:	Brendan Kearney
To:	1490Comments
Subject:	K-5 Science Standards
Date:	Saturday, October 24, 2015 10:26:41 AM

Hello,

I cannot make the meeting, but wanted my voice to be heard…

The engineering standards MUST be included for our students. The process is such a powerful experience that will help promote problem-solvers in our community. Please, put engineering back into our schools!!!

Thank you,
Brendan Kearney
K-5 Science Specialist
Glenridge Elementary
Clayton School District

From: Sarah Spilman
To: 1490Comments
Subject: Proposed Science Learning Standards
Date: Friday, October 23, 2015 4:27:18 PM

I am open to the changes being made in the standards because we know that over time changes need to happen. However as a teacher in a rural district, I feel like the standards in general are confusing compared to what we have been using. I teach in a K-12 building, and I teach science to 7th-12th grades. This alone is reason enough for the standards to be clear and easily understood by all.

The standards for 6th-8th are confusing because they are not specific to grade level. I have looked to find this information, but I have not had any luck in finding it. I am assuming this will be set at a later date, but based on my previous experience with education reform, I am also assuming that it is meant to be confusing.

The high school standards, similar the 6th-8th, are not specific to the course. If I am teaching a specific course, I want to know what I am responsible for teaching. As teachers, we are held to a higher standard based on the practices in our classroom. Spending additional time deciphering what I should be teaching would be a waste of my time. I want to be a teacher who makes a difference in her student's lives, not a teacher who is just trying to get the material covered because of a standardized test that decides whether or not I will have a job the following year.

Sarah Spilman
Science Teacher
Kingsville High School
101 E. Adriatic
Kingsville, MO 64061
(816)597-3422 x231

"Education is the most powerful weapon which you can use to change the world." --Nelson Mandela

From: Kelsie Biebighauser
To: 1490Comments
Subject: Missouri standards.
Date: Friday, October 23, 2015 8:56:16 AM

I love the new application of the science standards. It is great how they are based off the NGSS and focus on application of science concepts. I am currently teaching life science. My one grievance is that the standards say there are NO middle school standards under inheritance and variation of traits. The NGSS clearly lays out the standards for this section AND our current GLES have standards in this section. I feel that it is unreasonable to just drop a whole section of study from our curriculum (especially one so important). And yet, there are still 3-4 other standards in other strands that talk about genetic variation, except the whole strand where we guide them through variation of traits is gone! This makes absolutely no sense. For instance: the following standards talks about influencing how traits are inherited, but our students will have no knowledge of Punnett squares, genes, and inheritance. If I am going to have to teach the background knowledge anyway, why don't we have those standards?
Please consider adding the variation of traits strand back into the section for 6-8 standards.

MS- Gather and synthesize information about the technologies that have changed the way humans influence the inheritance of desired traits in organisms. [Clarification LS4-3. Statement: Emphasis is on synthesizing information from reliable sources about the influence of humans on genetic outcomes in artificial selection (such as genetic

modification, animal husbandry, and farming practices).]

Thank you.
Kelsie Biebighauser
6th grade science teacher
kbiebighauser@estigers.k12.mo.us