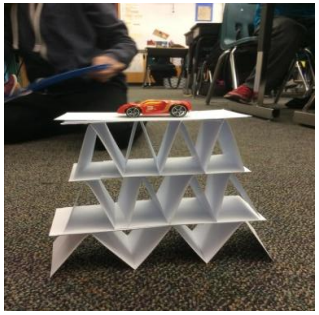
PACIFICA
SCHOOL DISTRICT

Science Plan
2015-2020

Pacifica School District Vision for Science Learning

We envision a community of student scientists whose curiosity and engagement drives them to wonder, explore, experiment, and think critically about 21st century concepts in science, technology, engineering, and the environment. Through the inquiry process students will make real world connections and become scientifically literate, responsible citizens able to effectively communicate across curricula.

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Introduction

The 2015–2020 Pacifica School District Strategic Plan was created to address the shift in content and practices that are reflected in the Next Generation Science Standards (NGSS) that California adopted on September 4, 2013. The new standards call for a different approach to teaching science, engineering, and technology. The overarching goal is "to ensure that by the end of 12th grade, *all* students have some appreciation of the beauty and wonder of science; are careful consumers of scientific and technological information related to their everyday lives; are able to continue to learn about science outside of school; and have the skills to enter careers of their choice, including (but not limited to) careers in science, engineering, and technology." –A Framework For K–12 Science Education, National Research Council.

The Next Generation Science Standards are three-dimensional and include cross-cutting concepts, science and engineering practices, and disciplinary core ideas. The role of the 21st Century teacher is not just to impart knowledge, but to provide learning experiences that engage students in the application of science and engineering to deepen their understanding. As our world becomes increasingly complex, there is a paramount need for students to be scientifically literate citizens. "We anticipate that the insights gained and interest provoked from studying and engaging in the practices of science and engineering are instrumental in addressing major challenges that confront society today, such as generating sufficient energy, preventing and treating diseases, maintaining supplies of clean water and food, and solving the problems of global environmental change."

The NGSS classroom will shift from being less teacher-directed to more student-centered. There will be less teacher prescribed labs and experiments. Instead, students will generate their own experiments, investigations, and projects to build science understanding. There will be less emphasis on memorization of scientific facts and more application of scientific knowledge and critical thinking skills to real-world situations. Students will use productive discourse to work collaboratively and explain their reasoning and thinking. Reading and writing will be a purposeful component of science learning and communicating.

Principles of Teaching and Learning Science

Students engaged in learning science:

- Actively participate in productive inquiry-based conversations
- Are motivated by their own curiosity, work at their appropriate skill level, and show resilience when encountering challenges
- Ask meaningful questions from their observations of the world around them
- Work collaboratively to plan and carry out investigations
- Use appropriate tools, materials and technology to develop models that aid in problem-solving
- Collect and interpret data through experimentation to draw conclusions
- Use mathematical and computational thinking to understand and explain concepts
- Find solutions to problems and develop reasonable explanations through collaborative discussions
- Use critical thinking to construct viable arguments employing evidence that supports their claims
- Apply reading, writing, and speaking skills to clearly and effectively communicate findings from investigations
- Apply the general process of scientific inquiry across curricula
- Apply cycle of inquiry process to analyze outcomes and revise experimental design

In the classroom, exemplary science teachers:

- Pose meaningful questions that encourage critical thinking, inquiry, and investigation
- Design and implement experiments and simulations that apply contemporary technology and tools
- Help students to understand and employ the Scientific Method as a tool for inquiry, investigation, and analysis of results
- Include examples of real-world science and engineering applications

- Foster an environment that promotes creativity and appropriate risk taking, allowing students to draw conclusions for themselves
- Encourage students to design and conduct their own experiments, use technology to explore abstract concepts, and communicate their results
- Connect cross-disciplinary knowledge and skills (i.e. math, history, reading and writing)
- Facilitate group discussions, encouraging communication among students and between students and teachers
- Offer opportunities for collaboration between students and within the community
- Provide a variety of summative and formative assessments
- Consider cultural and personal values in science, and how they impact society

Professional science teachers:

- Engage in district-supported professional development in science to increase knowledge of current methods and applications.
- Collaborate with colleagues within schools, grade levels, and across the district to ensure coherence and alignment as students progress from Kindergarten to eighth grade.
- Collaborate with high school district and teachers to ensure successful transition
- Create, implement, and analyze common assessments using district approved curricula that provide a window into students' understanding of important scientific concepts.
- Seek out and participate in professional development through local and national resources
- Learn by observing colleagues within schools, grade levels, and across the district to see examples of innovative techniques, applications, and approaches.
- Observe diverse learners and prepare teaching plans to help all students develop meaningful understanding of science and engineering

PSD Science Program and Content Standards

Goals:

1. Align science instruction to meet the Next Generation Science Standards (NGSS) and support ELA Anchor Standards and ELD Standards
2. Research and purchase NGSS aligned instructional materials

Standards: Next Generation Science Standards (NGSS)- Science and engineering content and practice standards

Instructional Materials We Use:

District Adopted Texts: K-5 FOSS, 6-8 CPO Science

Supplemental Resources for Support and Enhancement:

Mystery Science, Defined STEM, OUSD Secondary Science, Environmental Education Initiative(EEI), PSD Computer Science STARLogo Units

Assessment:

How We Know Students Are Learning

- Text based summative assessments
- Formative assessments
- NGSS aligned rubrics for projects
- NGSS Standardized Tests (2019)
- Daily checks for student understanding

NGSS Transition Timeline

2013	2014–2015	2015–2016	2016–2017	2017–2018	2018–2019	2019-2020
K–5		Awareness Phase	Transition to Science and Engineering Practice Standards (SEPs)	Transition to Cross Cutting Concepts (CCC)	Begin Transition to Disciplinary Core Ideas (DCIs) ---------- *Instructional Materials (SBE) *NGSS Assessment: 5th grade	Continue Transition to Disciplinary Core Ideas (DCIs) ---------- Adopt Instructional Materials
6–8	Awareness Phase	Transition to Science and Engineering Practice Standards	Transition to Cross Cutting Concepts (CCCs) ---------- 6th Grade: Begin Transition to Integrated Disciplinary Core Ideas (DCIs)	6th Grade: Continue Transition to DCIs ---------- -- 7th Grade: Begin Transition to Integrated DCIs	6th and 7th Grade: Continue transition to DCIs ---------- 8th Grade: Begin Transition to Integrated DCIs ---------- *Instructional Materials (SBE) *NGSS Assessment: 8th grade	Full NGSS Implementation ---------- Adopt Instructional Materials

Strategic Areas of Science Focus: The table below provides an overview of nine strategic areas of focus that will enable us to teach our vision for student learning of science. These areas of focus address the three interrelated components of the district strategic plan that recognize our students' right to learning that is rigorous, differentiated, and holistic. These areas of focus address what students need to learn, how we can assess student progress, and create and maintain healthy learning environments. They also address ways teachers collaborate and develop professionally in order to provide students with learning experiences that build a strong foundation to be scientifically literate citizens and have opportunities in the fields of science and engineering.

I. Learning that is rigorous

I.A. Plan and implement transition to the Next Generation Science Standards	I.B - Provide professional development related to Science and Engineering Practices, 21st century skills, NGSS content shifts, active and inquiry-based learning, and integration of other disciplines in science	I.C - Provide resources to develop and implement formative and summative assessments to measure depth and application of knowledge	I.D - Implement curriculum and projects that are NGSS aligned, hands-on, inquiry based, and incorporate 21st century skills

II. Learning that is differentiated

II.A - Implement multiple research-based strategies to support diverse learners	II.B - Utilize formative and summative assessments to offer students opportunities to demonstrate individual growth

III. Learning that is holistic

III.A - Provide and promote teacher collaboration opportunities for grade-alike, cross-curricular planning and vertical articulation	III.B - Encourage school- and district-wide Science events that foster family involvement	III.C - Reach out to community members and organizations to partner with schools, teachers, and students to support science learning

I. Science: Learning that is rigorous

I.A – Plan and implement transition to the Next Generation Science Standards

Timeline	Action Steps & Activities	Measures & Indicators of Impact	Required Resources & Key People
Phase 1: Awareness (2015–2017)	• Increase awareness and shift instruction to incorporate Science and Engineering Practice Standards (SEPs) and Cross Cutting Concepts (CCCs) K-8 • Partner with SMCOE to review NGSS-available instructional materials, resources, programs, and instructional models • Initiate development of Professional Learning Communities (PLCs) for collaborative planning and assessing • Pilot NGSS instructional materials • Science committee will meet tri-annually to monitor, revise, and update science plan and	• Teachers know and understand how to apply Science and Engineering Practice standards, as measured by surveys, formal and informal feedback. • Report findings from research programs, instructional materials, and resources	• STEM Specialist • Teacher leaders • SMCOE STEM coordinator

	ensure equity across schools • Offer PBL professional development opportunities • Participate in NSTA and other regional conferences		
Phase 2: Transition (2017–2019)	• Offer Professional Development on integrating SEPs, CCCs and DCIs (Disciplinary Core Ideas) • Continue development of and involvement in Professional Learning Communities (PLC) • Continue to pilot and adapt current material to the NGSS (FOSS, Amplify, Mystery Science, EEI, Defined STEM, CPO) • Preparation for 2019 NGSS assessments • Begin transition from content standards to Disciplinary Core Ideas • Continue to offer PBL Professional Development opportunities • Continued participation - NSTA & other regional conferences	• Percent of teacher participation in PLCs • Report findings from researching programs, instructional materials, and resources • Teachers know and understand how to apply CCCs and DCIs as measured by surveys, formal and informal feedback.	• STEM Specialist • Teacher leaders • SMCOE STEM coordinator

Phase 3: Implementation (2019–2020)	• Support teachers in full implementation of NGSS (SEPs, CCCs, and DCIs) • Adopt NGSS Instructional materials based on SBE list, assessment, and pilots • Continue to partner with SMCOE to keep up to date on professional development, programs, and resources • Continued participation in PLCs • Revise and adapt instruction based on assessment data and best practices • Continued participation in NSTA and other regional conferences	• Statewide tests • Data analysis • Percent of teacher participation in PLCs	• STEM Specialist • Teacher leaders • SMCOE STEM coordinator

I.B - Provide, support, and encourage professional development related to Science and Engineering Practices, NGSS content shifts, 21st C Skills, active and inquiry-based learning, and integrating science across disciplines

Timeline	Action Steps & Activities	Measures & Indicators of Impact	Required Resources & Key People
Phase 1: Awareness (2015–2017)	• District and teacher leaders attend conferences and professional development related to NGSS, PBL, and 21st Century Skills • Provide professional development that focuses on Science and Engineering Practices (SEPs) • Partner with SMCOE and utilize PD opportunities offered at SMCOE that support these goals • Research and seek community organizations, programs, and grants with which to develop partnerships • Observe model schools	• Evaluations and feedback from conferences and PD sessions • Classroom evidence of Science and Engineering practices, inquiry-based learning, and 21st Century Skill development in effect • Attendance at PDs and conferences • Partnerships developed	• STEM Specialist • Teacher Leaders • Science committee • SMCOE coordinators

Phase 2: Transition (2017–2018)	• Continue focus on integrating SEPs • Provide professional development that focuses on Cross Cutting Concepts (CCCs) • Provide resources and collaboration time for cross disciplinary instruction	• Evaluations and feedback from conferences and PD sessions • Classroom evidence of CCCs and SEP development in effect • Attendance at PDs and conferences	• STEM Specialist • Teacher Leaders • Science committee • SMCOE coordinators
Phase 3: Implementation (2018–2020)	• Continue offering teacher leaders opportunities to attend conferences and PD • Professional development on integrating Disciplinary Core Ideas (DCIs) with CCCs and SEPs	• Evaluations and feedback from conferences and PD sessions • Classroom evidence of implementation of DCIs, CCCs, and SEPs • Attendance at PDs and conferences	• STEM Specialist • Teacher Leaders • Science committee • SMCOE coordinators

I.C - Develop and utilize Formative and Summative assessments to measure depth of knowledge			
Timeline	Action Steps & Activities	Measures & Indicators of Impact	Required Resources & Key People
Phase 1: Awareness (2015–2017)	• Understand the Levels of Thinking in Bloom's Taxonomy and Webb's Depth of Knowledge • Examine existing materials • Understand the use of formative and summative assessments to measure D.O.K. and drive instruction	• Teacher evaluations and feedback related to professional development • Determining viability of current teaching materials and resources	• Science committee • SMCOE coordinators • STEM Specialist • Computers for SBAC interim and summative assessments
Phase 2: Transition (2017–2018)	• Design and modify rubrics that measure depth of knowledge • Research web based formative and summative assessment resource • Research NGSS aligned performance assessments • Partner with SMCOE for assessment resources	• Analysis of formative and summative assessment data	• STEM Specialist • Teacher Leaders • SMCOE coordinators

Phase 3: Implementation (2018–2020)	• Use formative assessments to measure D.O.K. • Utilize differentiated formative assessments • Collaborate and use results from formative assessments to drive instruction • Utilize SBAC interim and summative assessments • Develop common district-wide practice assessments for 4th and 7th grade	• Analysis of formative and summative assessment data	• STEM Specialist • Teacher Leaders • SMCOE coordinators

I.D- Implement NGSS aligned curriculum that is inquiry based and develops students' 21st century skills			
Timeline	Action Steps & Activities	Measures & Indicators of Impact	Required Resources & Key People
Phase 1: Awareness (2015–2017)	• Increase awareness around the Science and Engineering Practice Standards K-8 • Shift instruction to incorporate Science and Engineering Practice Standards K-8 • Partner with SMCOE to investigate NGSS instructional	• Professional development evaluations • Analysis of programs, instructional materials, and resources	• STEM Specialist • 6-8th grade science teachers • K-5 teacher leaders • SMCOE coordinators

	materials and research resources, programs, and instructional models • examine and adapt current curriculum to implement SEPs • Pilot supplemental NGSS materials		
Phase 2: Transition (2017–2018)	• Shift instruction to incorporate CCCs • Use PBL model to integrate NGSS across content areas • Evaluate new instructional materials and curriculum	• Data and analysis of curriculum and instructional materials	
Phase 3: Implementation (2018–2020)	• Adopt/develop and implement new instructional materials • Provide and replenish science support materials • Ensure equitable distribution of science materials across district • Create a transparent process for materials distribution and purchase	• Inventory of site materials	• District point person for ordering and maintaining supplies

II. Learning that is differentiated

II.A. Implement research based strategies to support diverse learners			
Timeline	Action Steps & Activities	Measures & Indicators of Impact	Required Resources & Key People
Phase 1: Awareness (2015–2017)	• Research programs and models of instruction that support all learners • Conduct professional development on best practices for teaching and engaging all students • Use PBL instruction to ensure inclusive instructional strategies that build on students' interest and backgrounds • Develop an inclusive classroom environment that provides opportunities for students to participate in SEPs	• Evaluations from programs reviewed • Feedback from Professional development • Classroom observations	• STEM Specialist • Teacher leaders • Principals

Phase 2: Transition (2017–2019)	• Use PLCs and collaboration time to identify students that need additional support and develop support plans • Create a classroom environment that values multiple modes of expression, has high expectations of all learners, and is student centered • Offer a variety of learning experiences, including differentiated assessments		• STEM Specialist • Teacher leaders • Principals
Phase 3: Implementation (2019–2020)	• Develop and use formative and summative assessments to identify achievement gaps and drive instruction • Use CAASP & interim assessments to identify achievement gaps	• Analysis of CAASP data • Analysis of formative and summative assessment data	• STEM Specialist • Teacher leaders • Principals

IIB. Utilize formative and summative assessments that offer students opportunities to demonstrate individual student growth			
Timeline	Action Steps & Activities	Measures & Indicators of Impact	Required Resources & Key People
Phase 1: Awareness (2015–2017)	• Introduce use of formative assessments and tasks to demonstrate student growth • Support student choice in assignments assessments	• Assessment data • Student feedback on Healthy Kids Survey regarding student voice and choice	• STEM Specialist • Teacher leaders • Principals
Phase 2: Transition (2017–2018)	• Research curriculum & programs that include formative assessments • Increase awareness on using data to identify target groups, meet student needs and address misconceptions	• Analysis of programs researched	• STEM Specialist • Teacher leaders • Principals
Phase 3: Implementation (2018–2020)	• Develop and use common formative and summative • Develop a feedback protocol for teachers to use with common assessments	• Development tasks and protocols • Analysis of tasks • Teacher feedback	• STEM Specialist • Teacher leaders • Principals

III. Learning that is holistic

III.A Provide opportunities for teacher collaboration for grade alike, cross curriculum, and vertical articulation			
Timeline	Action Steps & Activities	Measures & Indicators of Impact	Required Resources & Key People
Phase 1: Awareness (2015–2017)	• Embed collaboration time for site and district wide collaboration time in PD plan • Use collaboration time to review SEPs and develop modifications to current curriculum to meet SEPs • Develop relationship and communication pathways with JUHSD Science department	• Time allotted during the work day and during PD days for collaboration • Evaluations and feedback that measures understanding of SEPs, CCCs, and DCIs	• STEM Specialist • Teacher leaders • Principals
Phase 2: Transition (2017–2018)	• Use collaboration time to compare disciplinary core ideas (DCIs) and content shifts within & across grade levels • Collaboratively develop a plan to shift content while ensuring no content is lost during transition	• Analysis of curriculum • Developed transition plan	• STEM Specialist • Teacher leaders • Principals

	• Review new curriculum and share findings from pilot programs		
Phase 3: Implementation (2018–2020)	• Use site and district collaboration time to share best practices and resources • Collaboratively review student work on formative and summative assessments and tasks, give feedback, share findings, and plan next steps • Collaboratively plan and develop school wide, district wide, and county wide participation in STEM projects	• Samples of student work • Number of student participants in district wide and county wide STEM projects	• STEM Specialist • Teacher leaders • Principals

III.B. Encourage school- and district-wide Science events that foster family involvement			
Timeline	Action Steps & Activities	Measures & Indicators of Impact	Required Resources & Key People
Phase 1: Awareness (2015–2017)	• Encourage teachers and parents to participate in and learn about science fair opportunities, such as San Mateo's STEM fair.	• Number of participating teachers and	• STEM Specialist • Teacher leaders

	• Invite and encourage teachers to observe science fairs within and outside of our school district • Reach out to and invite parents that are scientists to participate in school, as guest speakers or facilitators	students • Teacher and parent feedback	• Principals
Phase 2: Transition (2017–2018)	• All 7th / 8th grade students will have the opportunity to participate in a science fair at their site and invite parents and community members • Offer parent education events on NGSS and best practices • Share strategies and opportunities with teachers and parents to engage families in science	• Number of participating teachers and students • Student, parent, and teacher feedback	• STEM Specialist • Teacher leaders • Principals
Phase 3: Implementation (2018–2020)	• All 7th /8th graders will have an opportunity to participate in district and county- wide science fairs • Extend Ortega's science night (or STEM night) to all schools, invite parents and community members	• Student, parent, and teacher feedback	• STEM Specialist • Teacher leaders • Principals

III.C. Partner with community members and organizations			
Timeline	Action Steps & Activities	Measures & Indicators of Impact	Required Resources & Key People
Phase 1: Awareness (2015–2017)	• Make a plan to reach out to community members and organizations, encourage community involvement, and create partnerships with schools around science • Utilize SMCOE and RAFT opportunities for teachers and students to participate in county-wide projects • Continue collaboration with Pacifica Education Fund (PEF) to develop and integrate computer science and engineering opportunities • Continue to work with Pacifica Beach coalition and participate in Earth Week activities • Apply for grants to develop partnerships with outside organizations	• Surveys and feedback • Number of participating organizations • Number of teachers participating in SMCOE and RAFT opportunities	• STEM Specialist • Teacher leaders • Principals

	• Research service learning opportunities		
Phase 2: Transition (2017–2018)	• Using the PBL model, middle school students will present their projects to community members • Continue to search out and apply for grants • Continue to develop relationships with outside organizations • Invite science experts and professionals to present at schools	• Number of teachers creating opportunities for students to participate in PBL and community projects	• STEM Specialist • Teacher leaders • Principals
Phase 3: Implementation (2018–2020)	• Maintain ongoing partnerships with organizations and professionals • Continue and expand on community events at each school site	• Number of teachers participating in partnerships with organizations and professionals	• STEM Specialist • Teacher leaders • Principals

Appendix A

Scientific and Engineering Practices

1. Asking questions (for science) and defining problems (for engineering)
2. Developing and using models
3. Planning and carrying out investigations
4. Analyzing and interpreting data
5. Using mathematics and computational thinking
6. Constructing explanations (for science) and designing solutions (for engineering)
7. Engaging in argument from evidence
8. Obtaining, evaluating, and communicating information

NEXT GENERATION SCIENCE STANDARDS

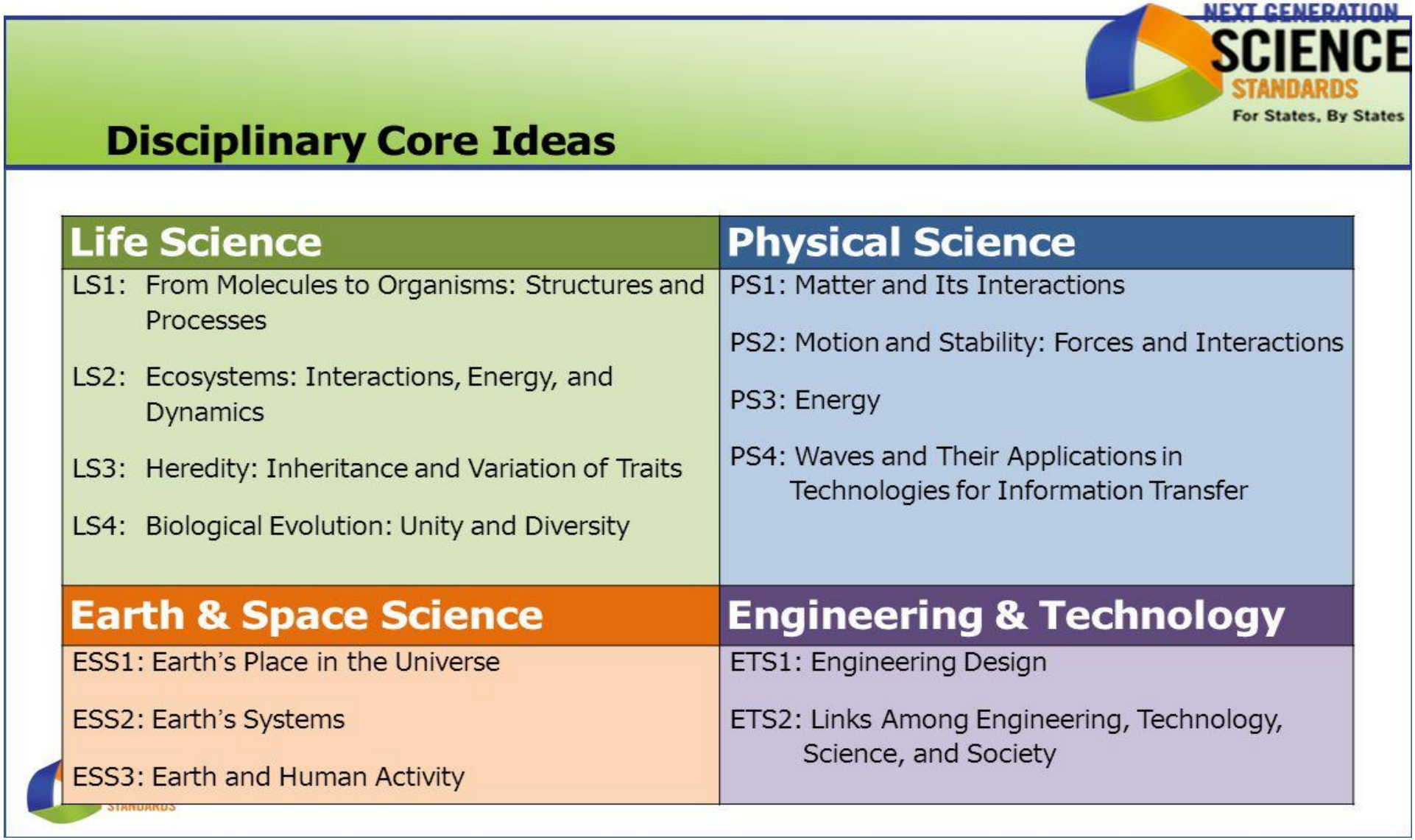
Appendix B

Crosscutting Concepts

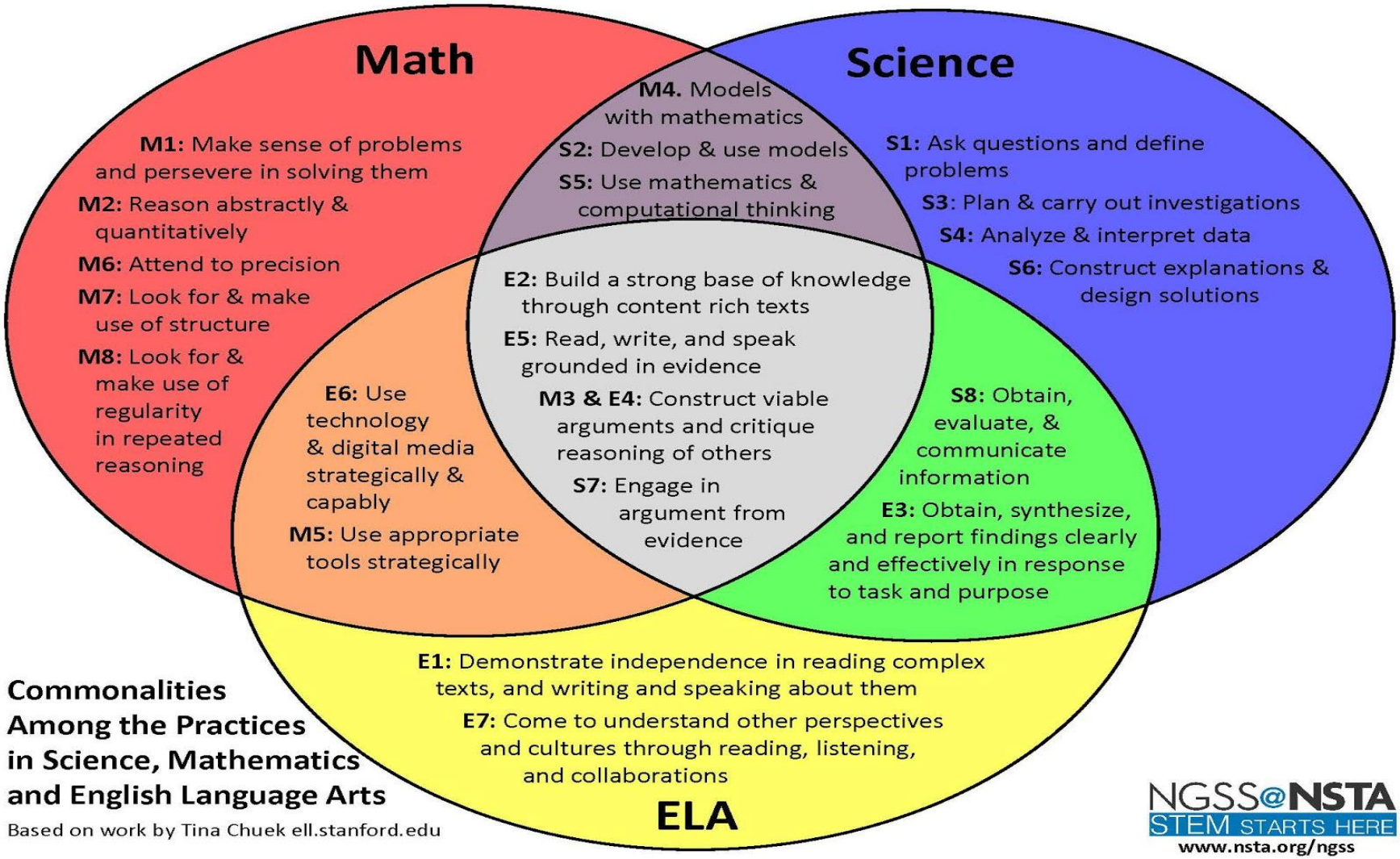
1. Patterns
2. Cause and Effect (Mechanism and Explanation)
3. Scale, Proportion, and Quantity
4. Systems and System Models
5. Energy and Matter (Flows, Cycles, and Conservation)
6. Structure and Function
7. Stability and Change

NEXT GENERATION SCIENCE STANDARDS

Appendix C


NEXT GENERATION SCIENCE STANDARDS
For States, By States
Disciplinary Core Ideas
Life Science
LS1: From Molecules to Organisms: Structures and Processes
LS2: Ecosystems: Interactions, Energy, and Dynamics
LS3: Heredity: Inheritance and Variation of Traits
LS4: Biological Evolution: Unity and Diversity
Physical Science
PS1: Matter and Its Interactions
PS2: Motion and Stability: Forces and Interactions
PS3: Energy
PS4: Waves and Their Applications in Technologies for Information Transfer
Earth & Space Science
ESS1: Earth's Place in the Universe
ESS2: Earth's Systems
ESS3: Earth and Human Activity
Engineering & Technology
ETS1: Engineering Design
ETS2: Links Among Engineering, Technology, Science, and Society

Appendix D


Math
Science
M1: Make sense of problems and persevere in solving them
M2: Reason abstractly & quantitatively
M6: Attend to precision
M7: Look for & make use of structure
M8: Look for & make use of regularity in repeated reasoning
M4. Models with mathematics
S2: Develop & use models
S5: Use mathematics & computational thinking
S1: Ask questions and define problems
S3: Plan & carry out investigations
S4: Analyze & interpret data
S6: Construct explanations & design solutions
E2: Build a strong base of knowledge through content rich texts
E5: Read, write, and speak grounded in evidence
M3 & E4: Construct viable arguments and critique reasoning of others
S7: Engage in argument from evidence
E6: Use technology & digital media strategically & capably
M5: Use appropriate tools strategically
S8: Obtain, evaluate, & communicate information
E3: Obtain, synthesize, and report findings clearly and effectively in response to task and purpose
E1: Demonstrate independence in reading complex texts, and writing and speaking about them
E7: Come to understand other perspectives and cultures through reading, listening, and collaborations
ELA
Commonalities Among the Practices in Science, Mathematics and English Language Arts
Based on work by Tina Chuek ell.stanford.edu
NGSS@NSTA
STEM STARTS HERE
www.nsta.org/ngss

Resources

- D.O.K. and the Common Core

http://www.crecnow.info/blendedsolutions/docs/docs/Webbs_Depth_of_Knowledge.pdf