Data Into Action

California Mathematics & Science Partnership
CaMSP Curriculum Products

Public Works

Pasadena, CA

About CaMSP

- A competitive grant program to implement innovative professional development programs through the Mathematics and Science Partnership Program under Title II, Part B, of No Child Left Behind Act of 2001, which ended in June 2017.
- Administered by the Science, Technology, Engineering and Mathematics (STEM) Office of the California Department of Education.
- Key Features of Programs funded under the CaMSP Initiative included:
  - Partnership Driven
  - Teacher Quality
  - Challenging Courses and Curricula
  - Evidence-Based Design and Outcomes
  - Institutional Change and Sustainability.

About Public Works

- Founded in 1998, Public Works is a nonprofit in Pasadena dedicated to working with communities, government, schools and parents by providing services and resources to educate and inform children, youth and families.

- Public Works served as the statewide evaluator of CaMSP since 2003 and a local evaluator to multiple partnerships in previous cohorts. Beginning in 2014, PW served as both the statewide evaluator and the local evaluator for the partnerships.

Public Works Role in Evaluation

- **Statewide Evaluation:** The impact of 60 hours of intensive and 24 hours of follow-up from a research PD model have on teacher and student outcomes.
  - Participating Teacher Survey, Partner Survey, Site Visits, Teacher Content Assessment, Student Outcome Study Using Statewide Assessments

- **Local Evaluation:** Develop local evaluation questions designed to prove the local PD model was effective in terms of teacher and student outcomes.
  - Teacher Surveys, Student Surveys, Classroom Observation, Lesson Study, and PLC Tools and Protocols, Coaching Logs, Lesson Plan Rubrics, Teacher Portfolios, Action Research, Student Notebooks, Benchmark Exams, etc.

Scope of CaMSP

- **From 2003 to 2017, 147 CaMSP partnerships through 15 separate cohorts serving teachers in grades 3 to 8 for science and 3 to Algebra I for mathematics including Research and Demonstration Cohorts.**
- 50 County Offices Served, 953 Districts, 5,423 Schools
- 19,483 Participating teachers and 1,086,582 Students
- 55 current projects in different stages of implementation:
  - 20 Cohort 10 partnerships in year 3 of STEM learning
  - 12 Cohort 11 partnerships in year 2 of STEM learning
  - 12 Cohort 12 partnerships in year 2 of math or science learning
  - 11 Cohort 13 partnerships in year 1 of math, science or STEM learning

Context for CaMSP Program

- Reauthorization of ESEA signed December 2015 under Every Student Succeeds Act (ESSA) rethinking of accountability systems and opportunities for professional learning supports.
- California continued to implementation of new standards in mathematics and science and prepare for Smarter Balanced Assessment in mathematics and English language arts; new state assessment in science developed by the state.
- Transition to support of professional development to integrate science, technology, engineering and mathematics (STEM) beginning in 2014.
- Transition to centralized local evaluation and technical assistance to support partnership data collection, teacher content testing and reporting under Public Works beginning in 2014.

CaMSP Challenging Courses & Curricula supported…

- Under Cohort 10 and 11, partnerships were required to produce STEM products or curricula for dissemination within their schools, districts and regions over the course of the three years of implementation.

- Partnerships created:
  - new single-disciplinary (math hands-on activity)
  - interdisciplinary (math and engineering lesson or series)
  - multi-disciplinary (multi-week project integrated across STEM disciplines) curriculum using a number of approaches or models
  - 5E Lessons and Units, Mathematics-focused Lesson Design, Project-Based Learning, and Curriculum Aligned Approaches.

- Examples of curriculum products and other instruments from CaMSP are provided on the following slides and appendix.

Lesson Templates and Rubrics

- Lesson Templates
  - **Butte COE (C10)** developed a comprehensive STEM lesson template including formative and summative assessments organized using the 5E model. The template asked teachers to identify NGSS and CCSS Mathematics and English language Arts standard and practices.
  - **Sacramento COE (C10)** teachers used a lesson template for creating lessons, through lesson study, with a focus on anticipated student responses that included intended student responses and possible misconceptions or errors.
  - **San Joaquin COE (C10)** included a computer modeling component in mathematics and science, and developed 5E lessons based on simulations that students explore through the lesson. The high school lessons included linear and quadratic equations, eccentricity of planet orbits, and radioactive decay.
  - **Tuolumne COE (C10)** used inquiry-based instruction and curriculum as essential to its professional development and incorporated the 5E instructional model and adapted its lesson tool from one developed by the American Museum of Natural History.

Lesson Templates and Rubrics

- Lesson and Unit Rubrics
  - **Butte COE (C10)** and **San Joaquin COE (C10)** each had rubrics assessing their respective teacher developed 5E lessons.
  - **National USD (C11)** created an *Evaluation Rubric for Units of Learning,* which is used in a variety of ways to assist the development of high quality NGSS curriculum. Teachers used this tool as a guide while creating units of learning and review the units, while the project team used the rubric to give feedback to teachers during the unit creation process.
  - The **EQUIP Rubric,** developed by Inquiry in Motion, was used to observe lessons in five partnerships: **ABC US (C10), Coachella Valley USD (C10), Escondido USD (C10), Lakeside USD (C10),** and **Oakland USD (C12).**

Curriculum Product Examples

- 5E (Engage, Explore, Explain, Evaluate, Extend)
  - **Lakeside USD (C10)** embedded conceptual flow and learning sequence in developed lessons. The lessons depict a conceptual flow where ideas are sorted into big concepts, supporting concepts, and smaller concepts or facts.
    - Conceptual Flow
    - Unit Overview/Storyline
    - Lesson

- Project-Based Learning
  - **Escondido USD (C10)** used project-based learning (PBL), including technology, and applying mathematics and engineering practices on a regular basis. Teachers used inquiry-based curriculum that integrated both the Common Core and NGSS standards.
    - Escondido Interdisciplinary Unit

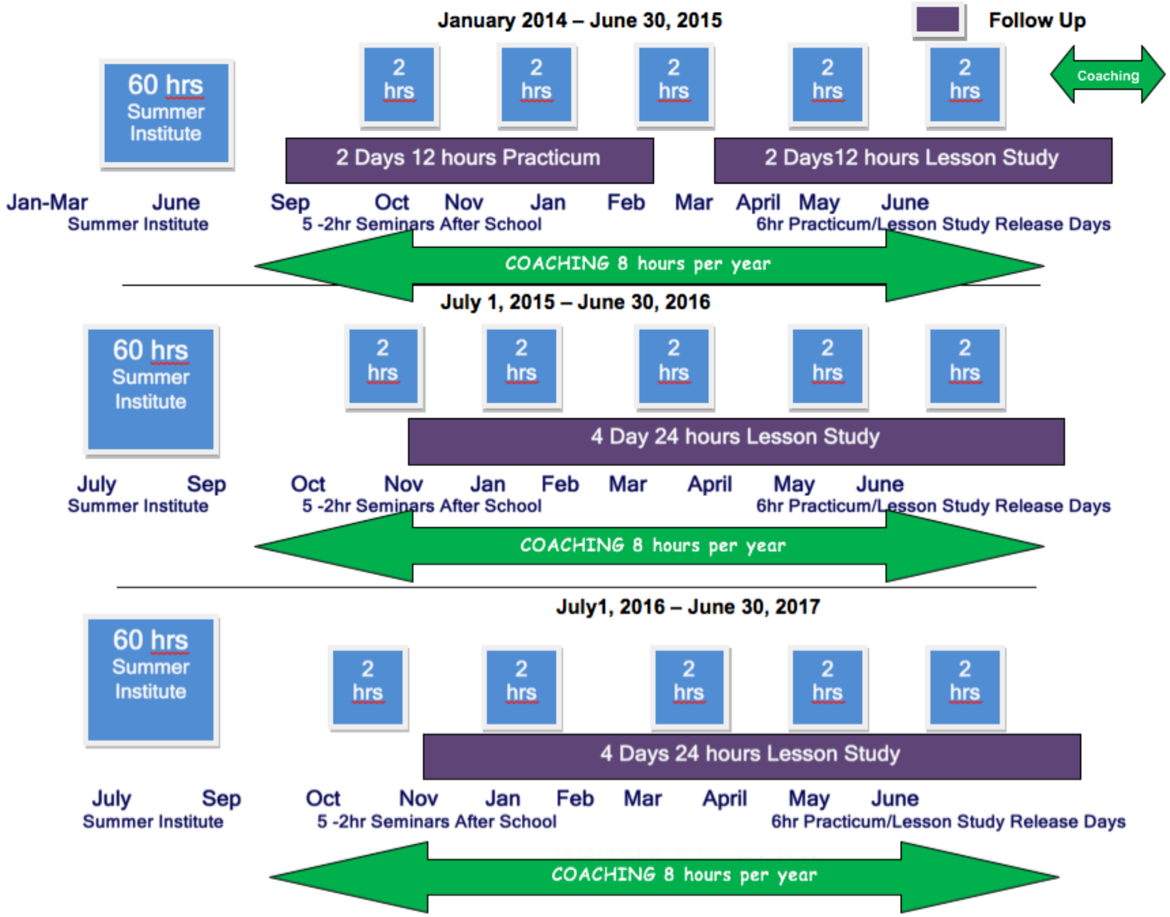
Tools for Classroom Implementation

- Classroom followup components supported teachers to practice and plan how to use what they had learned through the intensive professional development in the classroom, and form a continuum of support and professional collaboration.

- The three most common approaches to classroom followup include:
  - Coaching,
  - Lesson study, and
  - Professional Learning Communities (PLCs).

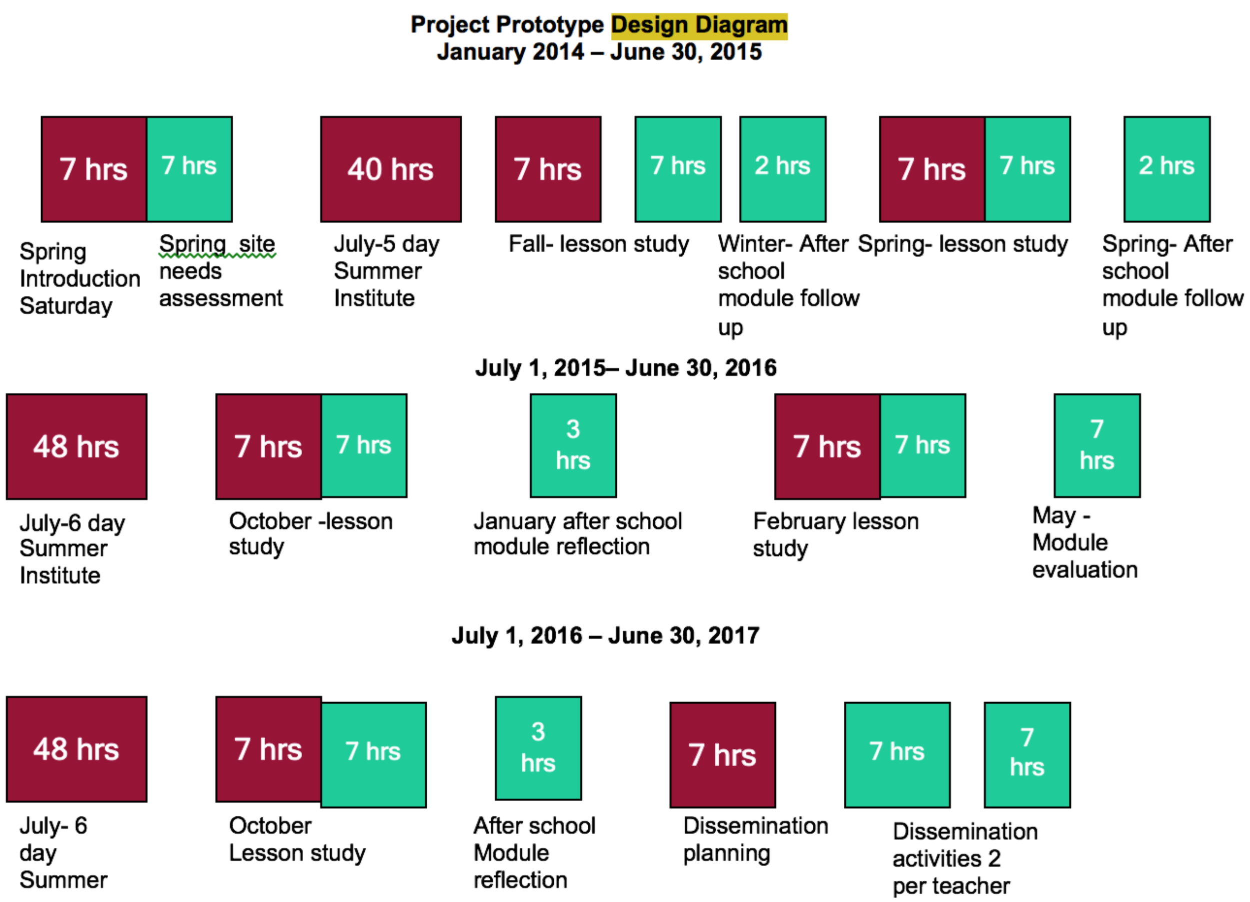
- Examples of various models and instruments from CaMSP are provided on the following slides.

Professional Development Designs – Coaching Model



PUBLIC WORKS

Professional Development Designs – Lesson Study Model



Coachella Valley USD- Project Prototype- Region 10

Lesson Study and Coaching Examples

- **Clovis USD (C12)** used a *Cognitively Guided Instruction* approach to student thinking, which provided opportunities for students to observe students engaged in problem solving and modeling exercises, and a basis for transitioning to lesson study as the model for classroom followup.
- **Pacheco Union ESD (C11)** partnerships that served grades K-2 did not have experience working with this grade level teacher. *The STEM Professional Learning Academy* from the summer were new experiences that felt like returning to college for some of the participants, but with the supports from the project, the teachers now have the most experience with NGSS in the region.
- **Riverside USD (C11)** used a Lesson Study Survey to provide feedback regarding the process of lesson study to improve improve implementation to meet the goal of developing highly-qualified, highly-motivated, extraordinary teachers who will influence the way students learn mathematics.

Appendices

iSTEM Lesson Planning Template

Grade/ Grade Band:	**Topic:**	**Lesson # _____ in a series of _____ lessons**
Brief Lesson Description:		
Performance Expectation(s):		
Specific Learning Outcomes:		

NARRATIVE/BACKGROUND INFORMATION		
Prior Student Knowledge (prior relevant standards):		
NGSS Science & Engineering Practices: Asking questions (science) and defining problems (engineering) Developing and using models Planning and carrying out investigations Analyzing and interpreting data Using mathematics and computational thinking Constructing explanations (science) and designing solutions (engineering) Engaging in argument from evidence Obtaining, evaluating, and communicating information	**CCSSM Standards for Math Practice:** 1. Make sense of problems and persevere in solving them. 2. Reason abstractly and quantitatively. 3. Construct viable arguments and critique the reasoning of others. 4. Model with mathematics 5. Use appropriate tools strategically. 6. Attend to precision. 7. Look for and make use of structure. 8. Look for and express regularity in repeated reasoning	**CCSSM English Language Arts Capacities:** E1. Demonstrate independence in reading complex texts, and writing and speaking about them. E2. Build a strong base of knowledge through content rich texts. E3. Obtain, synthesize, and report findings clearly and effectively in response to task and purpose. E4. Construct viable arguments and critique the reasoning of others. E5. Read, write, and speak grounded in evidence. E6. Use technology and digital media strategically and capably. E7. Come to understand other perspectives and cultures through reading, listening, and collaborations.
Disciplinary Core Ideas:	**CCSSM Content Standards:**	**ELA Standards:**
Crosscutting Concepts: **Patterns** **Cause and effect: Mechanism and explanation** **Scale, proportion, and quantity** **Systems and system models** **Energy and matter: Flows, cycles, and conservation** **Structure and function** **Stability and change**		
Possible Preconceptions/Misconceptions:		

LESSON PLAN – 5-E Model
ENGAGE: Opening Activity – Access Prior Learning / Stimulate Interest / Generate Questions:
EXPLORE: Lesson Description – Materials Needed / Probing or Clarifying Questions:
EXPLAIN: Concepts Explained and Vocabulary Defined: **Vocabulary:**
ELABORATE: Applications and Extensions:
EVALUATE: **Formative Monitoring (Questioning / Discussion):** **Summative Assessment (Quiz / Project / Report):**
Elaborate Further / Reflect: Enrichment:

Materials Required for This Lesson/Activity

QTY	Description	Potential Supplier (item #)	Est Price

EMITS LESSON STUDY TEMPLATE **Date:**
Fall/Spring Year 2

Title of Lesson		
Team Members		
Date	Grade level(s) and course(s) lesson was taught in:	
SMP Goal(s)	☐ 1. Make sense of problems and persevere in solving them. ☐ 2. Reason abstractly and quantitatively. ☐ 3. Construct viable arguments and critique the reasoning of others. ☐ 4. Model with mathematics.	☐ 5. Use appropriate tools strategically. ☐ 6. Attend to precision. ☐ 7. Look for and make use of structure. ☐ 8. Look for and express regularity in repeated reasoning.
Content Goal	When students finish the lesson, they will understand the following because… (mathematical reason). Note:	
Common Core Content Standards Actually paste in content standards language	Grade, Cluster, Number (this is to be amended to fit each team's needs)	
Previous HAVE's	What are the previous concepts/skills students need before this lesson?	

Mathematical Idea #					
Purpose:					

Time	Teacher Does or Asks	Anticipated Student Responses: Intended Student Responses	Anticipated Student Responses: Possible Misconceptions or Errors	Possible Back-Pocket Questions or Prompts	Where to note progress toward SMPG or CG

Lesson Plan Title

Lesson Objective:			
Course (Topic):		Lesson Duration (Period Minutes):	

NGSS	CCSS-M
Performance Expectation(s) **Disciplinary Core Idea(s)** **Cross Cutting Concept(s)**	**Domain(s)** **Content Standard(s)**
Science and Engineering Practice(s):	**Mathematics Practice(s):**

Lesson Plan Title

Materials:	

Engage: Connect to prior knowledge and experience. Focus students' thinking on learning outcomes.		**Estimated Time:**
Description:		
Conceptual Focus	**Teacher Does (including Questions to Ask)**	**Student Does (including Anticipated Responses)**

Lesson Plan Title

Explore: Students actively explore their environment or manipulate materials. Students identify and develop concepts, processes, and/or skills.		**Estimated Time:**
Description:		
Conceptual Focus	**Teacher Does (including Questions to Ask)**	**Student Does (including Anticipated Responses)**

Lesson Plan Title

Explain: Students explain the concepts they have been exploring. They verbalize their conceptual understanding or demonstrate new skills or behaviors. Teachers introduce formal terms, definitions, and explanations for concepts, processes, skills, and/or behaviors.	**Estimated Time:**
Description:	

Conceptual Focus	**Teacher Does (including Questions to Ask)**	**Student Does (including Anticipated Responses)**

Lesson Plan Title

Evaluate: Encourages learners to assess their understanding and abilities and lets teachers evaluate students' understanding of key concepts and skill development.	**Estimated Time:**

Description:

Conceptual Focus	Teacher Does (including Questions to Ask)	Student Does (Anticipated Responses)

Lesson Plan Title

Extend: Through new experiences, the learners develop deeper and broader understanding of concepts and refine their skills.	**Estimated Time:**

Description:

Conceptual Focus	**Teacher Does (including Questions to Ask)**	**Student Does (including Anticipated Responses)**

STEM Tracks

Lesson Template

Name:________________________________

Unit Title:__________________________________

Lesson # ______

Lesson Title:________________________________ **Grade Level:**______

Lesson Description

List the Big Idea related to this lesson and the Essential Question(s) being addressed.

List the NGSS Standards for this lesson.

Disciplinary Core Ideas:

Cross Cutting Concepts:

Science & Engineering Practices:

List the Math Standards addressed in this lesson.

Math Practices:

List the Technology Standards

Lesson Misconceptions

Assessment

List all the different assessments, both summative and formative, that are planned during this lesson.

Assessment Title	Assessment Type	Knowledge & Skills being assessed

Lesson Student Outcomes:

Materials:

Lesson Estimated Duration of Time:

Vocabulary:

Lesson Learning Sequence

Using the 5 E Lesson Design

E - Engage (How will you assess student's prior knowledge and interest them?)

E- Explore (What will the students do that facilities conceptual change?)

E - Explain (How will students explain their learning?)

E - Elaborate (How will the students gain a deeper understanding and be challenged to expand their thinking?)

E - Evaluate (How will the student's understanding be assessed?)

Notes:

List other resources and websites related to this lesson (Project WET, EEI, teachengineering.com, etc.)

Please attach copies of handouts or worksheets to be used in this lesson.

Category	3	2	1	Comments
1) Phenomenon/ Engagement Did the "hook" engage the students?	Full engagement due to relevance to real-life situations for all students.	Many students had low engagement due to lack of relevance to their experiences.	No engagement. The phenomenon/ hook that was utilized did not engage students.	
2) NGSS Practices Did the engagement evoke testable questions or present solvable problems?	Questions or problems are clear and testable and/or solvable as well as relevant to the original engagement.	Questions or problems are ambiguous and/or have only partial relevance to the original engagement.	No questions or problems are generated or questions are not testable or problems have no solutions available within the capacities of the students.	
3) ELA Capacities	ELA processes (speaking, listening, reading, or writing) utilized is clearly related to the testing or solution of the original question or problem.	The ELA processes (speaking, listening, reading, or writing) are partially related to the original question or problem.	ELA processes (speaking, listening, reading, or writing) are not present in this lesson.	
Math Practices	Standards for Mathematical Practice (SMPs) are clearly related to the focus of the lesson.	SMPs are partially related to the focus of the lesson.	SMPs are not present in the lesson.	
Technology Connection	Technology is clearly integrated into the lesson.	Technology is partially integrated into the lesson.	Technology is not integrated into the lesson.	
4) Five E Learning Cycle	At least 4 of the "5 E's" are present in the lesson.	3 of the 5 E's are present in the lesson.	Less than 3 of the 5 E's are present in the lesson.	
5) Achieved Learning Outcomes Evaluation measures were taken to determine learning outcomes	Learning outcomes were clearly and completely assessed and are aligned with performance expectations.	Learning outcomes were partially assessed and partially aligned with performance expectations.	Learning outcomes were not measured or not aligned with performance expectations.	

Lesson Study Rubric to Measure Success of the Lesson iSTEM Year 2 (Requirement: at least 2 of the STEM letters be included)

5E Rubric-Goldston

1. **Concepts and/or skills selected for the lesson align with NGSS.**
Mark only one oval.

0	1	2	3	4
⬭	⬭	⬭	⬭	⬭

2. **The lesson includes students using one or more of the Eight Mathematical Practices. Check all that are present.**
Check all that apply.

- [ ] Make sense of problems and persevere in solving them
- [ ] Reason abstractly and quantitatively
- [ ] Construct viable arguments and critique the reasoning of others
- [ ] Model with mathematics
- [ ] Use appropriate tools strategically
- [ ] Attend to precision
- [ ] Look for and make use of structure
- [ ] Look for and express regularity in repeated reasoning

3. **The lesson plan contains objectives that are clear, appropriate, measurable, and align with the assessment/evaluation.**
Mark only one oval.

0	1	2	3	4
⬭	⬭	⬭	⬭	⬭

4. **The engage elicits students' prior knowledge (based upon the objectives)**
Mark only one oval.

0	1	2	3	4
⬭	⬭	⬭	⬭	⬭

5. **The engage raises student interest/motivation to learn**
Mark only one oval.

0	1	2	3	4
⬭	⬭	⬭	⬭	⬭

6. **The engage provides opportunities for student discussion/questions (or invites student questions)**
Mark only one oval.

0	1	2	3	4
⬭	⬭	⬭	⬭	⬭

7. **The engage leads into the exploration**
Mark only one oval.

0	1	2	3	4
⬭	⬭	⬭	⬭	⬭

8. **During the explore phase, teachers present instructions**
Mark only one oval.

0	1	2	3	4
⬭	⬭	⬭	⬭	⬭

9. **Learning activities in the exploration phase involves hands-on/minds-on activities**
Mark only one oval.

0	1	2	3	4
⬭	⬭	⬭	⬭	⬭

10. **Learning activities in the exploration phase are student centered (When appropriate, teacher questions evoke the learners' ideas and/or generate new questions from students student inquiry may involve student questioning, manipulating objects, developing inquiry skills (as appropriate) and developing abstract ideas).***
Mark only one oval.

0	1	2	3	4
⬭	⬭	⬭	⬭	⬭

11. **The inquiry activities of the explore show evidence of student learning (formative/authentic assessment). ***
Mark only one oval.

0	1	2	3	4
⬭	⬭	⬭	⬭	⬭

12. **There is a logical transition from the explore phase to the explain phase**
Mark only one oval.

0	1	2	3	4
◯	◯	◯	◯	◯

13. **The explain includes teacher questions that lead to the development of concepts and skills (Draw upon the explore activities/data collected during the explore activities)**
Mark only one oval.

0	1	2	3	4
◯	◯	◯	◯	◯

14. **The explain includes mixed divergent and convergent questions for interactive discussion facilitated by teacher and/or students to develop concepts or skills**
Mark only one oval.

0	1	2	3	4
◯	◯	◯	◯	◯

15. **The explain includes a complete explanation of the concept(s) and/or skill(s) taught**
Mark only one oval.

0	1	2	3	4
◯	◯	◯	◯	◯

16. **The explain phase provides a variety of approaches to explain and illustrate the concept or skill. (For example, approaches might include but are not limited to the use of technology, virtual field trips, demonstrations, cooperative group discussions, panel discussions, interview of guys speaker, video/print/audio/computer program materials, or teacher explanations)**
Mark only one oval.

0	1	2	3	4
◯	◯	◯	◯	◯

17. **The discussion or activity during the explain phase allows the teacher to assess students' present understanding of concept(s) or skill(s)**
Mark only one oval.

0	1	2	3	4
◯	◯	◯	◯	◯

18. **There is a logical transition from the explain phase to the elaborate phase**
Mark only one oval.

0	1	2	3	4
◯	◯	◯	◯	◯

19. **The elaborate activities provide students with the opportunity to apply the newly acquired concepts and skills into new areas**
Mark only one oval.

0	1	2	3	4
◯	◯	◯	◯	◯

20. **The elaborate activities encourage students to find real-life (every day) connections with the newly acquired concepts or skills**
Mark only one oval.

0	1	2	3	4
◯	◯	◯	◯	◯

21. **The lesson includes summative evaluation, which can include a variety of forms/approaches.***
Mark only one oval.

0	1	2	3	4
◯	◯	◯	◯	◯

22. **The evaluation matches the objectives**
Mark only one oval.

0	1	2	3	4
◯	◯	◯	◯	◯

23. **The evaluation criteria are clear and appropriate**
Mark only one oval.

0	1	2	3	4
◯	◯	◯	◯	◯

24. **The evaluation criteria are measurable (i.e., rubrics)**
Mark only one oval.

0	1	2	3	4
◯	◯	◯	◯	◯

25. **Relevant safety issues are addressed. Appropriate safety equipment is delineated. Selection of materials is age appropriate**

Mark only one oval.

0	1	2	3	4
⬭	⬭	⬭	⬭	⬭

26. **The time specified in each of the lesson plan phases (exploration, intention, expansion) is appropriate**

Mark only one oval.

0	1	2	3	4
⬭	⬭	⬭	⬭	⬭

27. **Accommodations for students with special needs are addressed. Variety of cognitive levels is addressed throughout the lesson. The lesson is appropriate for all students**

Mark only one oval.

0	1	2	3	4
⬭	⬭	⬭	⬭	⬭

28. **The lesson plan includes a bibliography. Cited works include web sites, textbooks, children' literature, and relevant articles. Using only children's literature is not acceptable. Multiple sources must be used for content verifcation**

Mark only one oval.

0	1	2	3	4
⬭	⬭	⬭	⬭	⬭

Power Grant: Evaluation Rubric for NGSS Units of Learning

Overview, Background and Context	Assessments	Learning Sequence: NGSS	Learning Opportunities: Integrate CA Standards
☐ Appropriate Performance Expectation(s) are identified, verbs are underlined, and are clearly the focus of the unit ☐ Appropriate DCI are identified and addressed in the unit, ☐ Appropriate SEPs are identified and addressed in the unit, ☐ Appropriate CCCs are identified and addressed in the unit, ☐ Connections to the CA Math standards are identified and addressed in the unit. ☐ Connections to the CA ELA standards are identified and addressed in the unit. ☐ Necessary background information is provided ☐ The content is accurate ☐ The unit is relevant and interesting to students, with real-world connections and applications ☐ The Learning and Instructional Sequence provides a conceptual flow that will lead to mastery of the Performance Expectation(s) and uses the 5 E model.	Multiple Measures that assess flow to the final performance task(s).are used to identify what students know, are able to do, understand, and next learning steps. *Assess knowledge and skills* ☐ Multiple choice: regular, enhanced (visuals, data), justify choice, T/F with justification or correct error, matching ☐ Observation *Assess enduring understanding* ☐ Interviews ☐ Products ☐ Open-ended Prompts: essay, short answer, CRI constructed response to investigation (data provided, support conclusion, provide justification, substantiate experimental results) *The performance task(s)* ☐ Are consistent with and fully assess the performance expectation(s). ☐ Are comprehensive, coherent, and focused on the integration of core and compound ideas, CCCs, and SEPs. ☐ Students get, manipulate, and analyze data ☐ Provides information that identifies what students know, understand, and are able to do.	*The learning sequence uses a variety of learning opportunities* ☐ 5E Model of Instruction ☐ Inquiry ☐ Project-based ☐ Problem-based ☐ Service-learning ☐ Engineering task ☐ Other: *Learning Opportunities* ☐ Integrate the 3 dimensions: SEPs, DCIs, and CCCs throughout ☐ Activate and/or build background knowledge, connect to prior learning, to natural phenomena ☐ Provide comprehensible input ☐ Provide multiple opportunities to experience concepts before vocabulary is introduced. ☐ Provide opportunities for purposeful interaction ☐ Provide opportunities to apply concepts and practices in different contexts. ☐ Provide opportunities for constructive feedback, revision ☐ Provide closure and move students to a more scientific understanding ☐ Provide opportunities for self-reflection: learning what, how, why ☐ Include formative/summative assessment throughout	*The learning opportunities:* ☐ Integrate LSRW to apply and advance literacy skills. ☐ Integrate and apply appropriate mathematics concepts and practices ☐ Facilitate rich and rigorous evidence-based **discussions** about common texts and experiments/trials through specific, thought-provoking, questions (including questions about illustrations, charts, graphs, tables, diagrams, audio, video, and media). ☐ Provide opportunities for students to **listen** carefully to the thinking of others and respond ☐ Use text(s) of sufficient quality and scope within grade-level text complexity band, **read** closely examining textual evidence, and discerning deep meaning as a central focus of instruction. ☐ Routinely expect that students draw evidence from texts and experiments/trials to produce clear and coherent **writing** that informs, explains, or makes an argument in various written forms (e.g., notes, summaries, short responses, formal essays).
Rating: 3 2 1 0	**Rating: 3 2 1 0**	**Rating: 3 2 1 0**	**Rating: 3 2 1 0**

Information from multiple resources, including EQuIP by Achieve, NSTA Workshop on Translating Lessons into Units for NGSS by Bybee and Bess, 2013., Buck Institute, Power Grant

<u>Rating Scale Descriptors</u>

3 – Exemplary: Meets most of the criteria in the dimension. **2** – Approaching: Meets many criteria in the dimension but would benefit from revision
1 – Developing: Meets few of the criteria in the dimension and needs significant revision **0** – Does not address the criteria in the dimension

As of 8/7/15

EQuIP Rubric for Lessons & Units: Science

Introduction

The Educators Evaluating the Quality of Instructional Products (EQuIP) Rubric for science provides criteria by which to measure the alignment and overall quality of lessons and units with respect to the Next Generation Science Standards (NGSS). The purpose of the rubric and review process is to: (1) provide constructive criterion-based feedback to developers; (2) review existing instructional materials to determine what revisions are needed; and (3) identify exemplars/models for teachers' use within and across states.

To effectively apply this rubric, an understanding of the National Research Council's *A Framework for K–12 Science Education and the Next Generation Science Standards*, including the NGSS shifts (appendix A of the NGSS), is needed. Unlike the EQuIP Rubrics for mathematics and ELA, there is not a column in the science rubric for shifts. Over the course of the rubric development, writers and reviewers noted that the shifts fit naturally into the other three columns. For example, the blending of the three-dimensions, or three-dimensional learning, is addressed in each of the three columns; coherence and connections to the Common Core State Standards are addressed in the first column; deeper understanding and application of content are addressed in the second column. Each column includes criteria by which to evaluate the integration of engineering, when included in a lesson or unit, through practices or disciplinary core ideas. Another difference between the EQuIP Rubrics from mathematics and ELA is in the name of the columns; the rubric for science refers to them simply as *columns*, whereas the math and ELA rubrics refer to the columns as dimensions. This distinction was made because the Next Generation Science Standards already uses the term *dimensions* to refer to practices, disciplinary core ideas, and crosscutting concepts.

The architecture of the NGSS is significantly different from other sets of standards. The three dimensions, crafted into performance expectations, describe what is to be assessed following instruction and therefore are the measure of proficiency. A lesson or unit may provide opportunities for students to demonstrate performance of practices connected with their understanding of core ideas and crosscutting concepts as foundational pieces. This three-dimensional learning leads toward eventual mastery of performance expectations. In this scenario, quality materials should clearly describe or show how the lesson or unit works coherently with previous and following lessons or units to help build toward eventual mastery of performance expectations. The term *element* is used in the rubric to represent the relevant, bulleted practices, disciplinary core ideas, and crosscutting concepts that are articulated in the foundation boxes of the standards as well as the in the NGSS appendices on each dimension. Given the understanding that a lesson or unit may include the blending of practices, disciplinary core ideas, and crosscutting concepts that are not identical to the combination of practices, disciplinary core ideas, and crosscutting concepts in a performance expectation, the new term *elements* was needed to describe these smaller units of the three dimensions. Although it is unlikely that a single lesson would provide adequate opportunities for a student to demonstrate proficiency on every dimension of a performance expectation, high-quality units are more likely to provide these opportunities to demonstrate proficiency on one or more performances expectations.

There is a recognition among educators that curriculum and instruction will need to shift with the adoption of the NGSS, but there is currently a lack of high-quality, NGSS-aligned materials. The power of the rubric is in the feedback it provides curriculum developers and the productive conversations educators have while evaluating materials (i.e., the review process). For curriculum developers, the rubric and review process provide evidence on the quality and alignment of a lesson or unit to the NGSS. Additionally, the rubric and review process generate feedback on how materials can be further improved and more closely aligned to the NGSS. As more NGSS lessons and units are developed, this rubric may change to meet the evolving needs of supporting both educators in evaluating materials and developers in the modification and creation of materials. Additionally, support materials will be developed to complement the use of this rubric, such as a professional development guide, a criterion discussion guide, and publishers' criteria that will be more focused on textbooks and comprehensive curriculums.

Directions

The first step in the review process is to become familiar with the rubric, the lesson or unit, and the practices, disciplinary core ideas, and crosscutting concepts targeted in the lesson or unit. The three columns in the rubric correspond to: alignment to the NGSS, instructional supports, and monitoring student progress. Specific criteria within each column should be considered separately as part of the complete review process and are used to provide sufficient information for determination of overall quality of the lesson or unit.

Also important to the review process is feedback to the developer of the resource. For this purpose a set of response forms is included so that the reviewer can effectively provide criterion-based observations and suggestions for improvement for each column. The response forms correspond to the criteria of the rubric. Evidence for each criterion must be identified and documented and criterion-based feedback should be given to help improve the lesson or unit.

While it is possible for the rubric to be applied by an individual, the quality review process works best with a team of reviewers, as a collaborative process, with the individuals recording their thoughts and then discussing with other team members before finalizing their feedback. Discussions should focus on understanding all reviewers' interpretations of the criteria and the evidence they have found. The goal of the process is to eventually calibrate responses across reviewers and to move toward agreement about quality with respect to the NGSS. Commentary needs to be constructive, with all lessons or units considered "works in progress." Reviewers must be respectful of team members and the resource contributor. Contributors should see the review process as an opportunity to gather feedback rather than to advocate for their work. All observations and suggestions for improvement should be criterion-based and have supporting evidence from the lesson or unit cited.

Note: This rubric will eventually have scoring guidelines for each column, as well as for an overall rating. However, given the current lack of high quality, NGSS-aligned materials, rather than focusing on ratings at this point in time, the focus should be on becoming familiar with the rubric and using it to provide criterion-based feedback to developers and make revisions to existing materials.

Step 1 – Review Materials

The first step in the review process is to become familiar with the rubric, the lesson or unit, and the practices, disciplinary core ideas, and crosscutting concepts targeted in the lesson or unit.

- Review the rubric and record the grade and title of the lesson or unit on the response form.
- Scan to see what the lesson or unit contains, what practices, disciplinary core ideas, and crosscutting concepts are targeted, and how it is organized.
- Read key materials related to instruction, assessment, and teacher guidance.

Step 2 – Apply Criteria in Column I: Alignment

The second step is to evaluate the lesson or unit using the criteria in the first column, first individually and then as a team.

- Closely examine the lesson or unit through the "lens" of each criterion in the first column of the response form.
- Individually check each criterion on the response form for which clear and substantial evidence is found and record the evidence and criterion-based suggestions for specific improvements that might be needed to meet criteria.
- As a team, discuss criteria for which clear and substantial evidence is found, as well as criterion-based suggestions for specific improvements that might be needed to meet criteria.

If the lesson or unit is not closely aligned to the Next Generation Science Standards, it may not be appropriate to move on to the second and third columns. Professional judgment should be used when weighing the individual criterion. For example, a lesson without crosscutting concepts explicitly called out may be easier to revise than one without appropriate disciplinary core ideas; such a difference may determine whether reviewers believe the lesson merits continued evaluation or not.

Step 3 – Apply Criteria in Columns II and III: Instructional Supports and Monitoring Student Progress

The third step is to evaluate the lesson or unit using the criteria in the second and third columns, first individually and then as a group.

- Closely examine the lesson or unit through the "lens" of each criterion in the second and third columns of the response form.
- Individually check each criterion on the response form for which clear and substantial evidence is found and record the evidence and criterion-based suggestions for specific improvements that might be needed to meet criteria.
- As a team, discuss criteria for which clear and substantial evidence is found, as well as criterion-based suggestions for specific improvements that might be needed to meet criteria.

When working in a group, teams may choose to compare ratings after each column or delay conversation until each person has rated and recorded input for the two remaining columns. Complete consensus among team members is not required but discussion is a key component of the review process.

EQuIP Rubric for Lessons & Units: Science

I. Alignment to the NGSS	II. Instructional Supports	III. Monitoring Student Progress

The lesson or unit aligns with the conceptual shifts of the NGSS:
o Elements of the science and engineering practice(s), disciplinary core idea(s), and crosscutting concept(s), blend and work together to support students in three-dimensional learning to make sense of phenomena or design solutions.
  o Provides opportunities to use specific elements of the practice(s) to make sense of phenomena or design solutions.
  o Provides opportunities to construct and use specific elements of the disciplinary core idea(s) to make sense of phenomena or design solutions.
  o Provides opportunities to construct and use specific elements of the crosscutting concept(s) to make sense of phenomena or design solutions.
 	
A unit or longer lesson:
o Lessons fit together coherently, build on each other, and help students develop proficiency on a targeted set of performance expectations.
o Develops connections between different science disciplines by the use of crosscutting concepts and develops connections between different science disciplines by using disciplinary core ideas where appropriate.
o Provides grade-appropriate connection(s) to the Common Core State Standards in Mathematics and/or English Language Arts & Literacy in History/Social Studies, Science and Technical Subjects.
	The lesson or unit supports instruction and learning for all students:
	o Engages students in authentic and meaningful scenarios that reflect the practice of science and engineering as experienced in the real world and that provide students with a purpose (e.g., making sense of phenomena or designing solutions).
	  o Provides students with multiple phenomena (either firsthand experiences or through representations) that support students in engaging in the practices.
	  o Engages students in multiple practices that blend and work together with disciplinary core ideas and crosscutting concepts to support students in making sense of phenomena or designing solutions.
	  o When engineering performance expectations are included, they are used along with disciplinary core ideas from physical, life, or earth and space sciences.
	o Develops deeper understanding of the practices, disciplinary core ideas, and crosscutting concepts by identifying and building on students' prior knowledge.
	o Uses scientifically accurate and grade-appropriate scientific information, phenomena, and representations to support students' three-dimensional learning.
	o Provides opportunities for students to express, clarify, justify, interpret, and represent their ideas and respond to peer and teacher feedback orally and/or in written form as appropriate to support student's three-dimensional learning.
	o Provides guidance for teachers to support differentiated instruction in the classroom so that every student's needs are addressed by:
	  o Connecting instruction to the students' home, neighborhood, community and/or culture as appropriate.
	  o Providing the appropriate reading, writing, listening, and/or speaking modifications (e.g., translations, front loaded vocabulary word lists, picture support, graphic organizers) for students who are English language learners, have special needs, or read well below the grade level.
	  o Providing extra support for students who are struggling to meet the performance expectations.
	  o Providing extensions consistent with the learning progression for students with high interest or who have already met the performance expectations.
	
	A unit or longer lesson:
	o Provides guidance for teachers throughout the unit for how lessons build on each other to support students developing deeper understanding of the practices, disciplinary core ideas, and crosscutting concepts over the course of the unit.
		The lesson or unit supports monitoring student progress:
		o Assessments are aligned to the three-dimensional learning.
		o Elicits direct, observable evidence of students' performance of practices connected with their understanding of core ideas and crosscutting concepts.
		o Formative assessments of three-dimensional learning are embedded throughout the instruction.
		o Includes aligned rubrics and scoring guidelines that provide guidance for interpreting student performance along the three dimensions to support teachers in (a) planning instruction and (b) providing ongoing feedback to students.
		o Assessing student proficiency using methods, vocabulary, representations, and examples that are accessible and unbiased for all students.
		
		A unit or longer lesson:
		o Includes pre-, formative, summative, and self-assessment measures that assess three-dimensional learning.
		o Provides multiple opportunities for students to demonstrate performance of practices connected with their understanding of disciplinary core ideas and crosscutting concepts and receive feedback.

EQuIP Rubric for Lessons & Units: Science

Response Form

Reviewer Name or ID: **Grade:**

Science Lesson/Unit Title:

I. Alignment to the NGSS

The lesson or unit aligns with the conceptual shifts of the NGSS:

Criteria	Specific evidence from materials under review	Suggestions for improvement
Elements of the science and engineering practice(s), disciplinary core idea(s), and crosscutting concept(s), blend and work together to support students in three-dimensional learning to make sense of phenomena or design solutions. o Provides opportunities to use specific elements of the practice(s) to make sense of phenomena or design solutions. o Provides opportunities to construct and use specific elements of the disciplinary core idea(s) to make sense of phenomena or design solutions. o Provides opportunities to construct and use specific elements of the crosscutting concept(s) to make sense of phenomena or design solutions.		

A unit or longer lesson:

Criteria	Specific evidence from materials under review	Suggestions for improvement
Lessons fit together coherently, build on each other, and help students develop proficiency on a targeted set of performance expectations.		
Develops connections between different science disciplines by the use of crosscutting concepts and develops connections between different science disciplines by using disciplinary core ideas where appropriate.		
Provides grade-appropriate connection(s) to the Common Core State Standards in Mathematics and/or English Language Arts & Literacy in History/Social Studies, Science and Technical Subjects.		

Summary of Observations and Suggestions for Improvement:

If the lesson or unit is not closely aligned to the Next Generation Science Standards, it may not be appropriate to move on to the second and third columns. Professional judgment should be used when weighing the individual criterion. For example, a lesson without crosscutting concepts explicitly called out may be easier to revise than one without appropriate disciplinary core ideas; such a difference may determine whether reviewers believe the lesson merits continued evaluation or not.

II. Instructional Supports

The lesson or unit supports instruction and learning for all students:

Criteria	Specific evidence from materials under review	Suggestions for improvement
Engages students in authentic and meaningful scenarios that reflect the practice of science and engineering as experienced in the real world and that provide students with a purpose (e.g., making sense of phenomena or designing solutions). o Provides students with multiple phenomena (either firsthand experiences or through representations) that support students in engaging in the practices. o Engages students in multiple practices that blend and work together with disciplinary core ideas and crosscutting concepts to support students in making sense of phenomena or designing solutions. o When engineering performance expectations are included, they are used along with disciplinary core ideas from physical, life, or earth and space sciences.		
Develops deeper understanding of the practices, disciplinary core ideas, and crosscutting concepts by identifying and building on students' prior knowledge.		
Uses scientifically accurate and grade-appropriate scientific information, phenomena, and representations to support students' three-dimensional learning.		
Provides opportunities for students to express, clarify, justify, interpret, and represent their ideas and respond to peer and teacher feedback orally and/or in written form as appropriate to support student's three-dimensional learning.		
Provides guidance for teachers to support differentiated instruction in the classroom so that every student's needs are addressed by: o Connecting instruction to the students' home, neighborhood, community and/or culture as appropriate. o Providing the appropriate reading, writing, listening, and/or speaking modifications (e.g., translations, front loaded vocabulary word lists, picture support, graphic organizers) for students who are English language learners, have special needs, or read well below the grade level. o Providing extra support for students who are struggling to meet the performance expectations. o Providing extensions consistent with the learning progression for students with high interest or who have already met the performance expectations.		

A unit or longer lesson:

Criteria	Specific evidence from materials under review	Suggestions for improvement
Provides guidance for teachers throughout the unit for how lessons build on each other to support students developing deeper understanding of the practices, disciplinary core ideas, and crosscutting concepts over the course of the unit.		

Summary of Observations and Suggestions for Improvement:

III. Monitoring Student Progress

The lesson or unit supports monitoring student progress:

Criteria	Specific evidence from materials under review	Suggestions for improvement
Assessments are aligned to the three-dimensional learning.		
Elicits direct, observable evidence of students' performance of practices connected with their understanding of core ideas and crosscutting concepts.		
Formative assessments of three-dimensional learning are embedded throughout the instruction.		
Includes aligned rubrics and scoring guidelines that provide guidance for interpreting student performance along the three dimensions to support teachers in (a) planning instruction and (b) providing ongoing feedback to students.		
Assessing student proficiency using methods, vocabulary, representations, and examples that are accessible and unbiased for all students.		

A unit or longer lesson:

Criteria	Specific evidence from materials under review	Suggestions for improvement
Includes pre-, formative, summative, and self-assessment measures that assess three-dimensional learning.		
Provides multiple opportunities for students to demonstrate performance of practices connected with their understanding of disciplinary core ideas and crosscutting concepts and receive feedback.		

Summary of Observations and Suggestions for Improvement:

EQuIP Rubric for Lessons & Units: Science

Response Form

Reviewer Name or ID: **Grade:**

Science Lesson/Unit Title:

Overall Summary Comments:

Energy and Waves

Anchor Phenomenon:
Fireworks make light and sound;
storms have thunder and lightening

Energy travels in waves and can change

Buoy bobbing in water

Energy travels in waves

Waves can be described by amplitude and wavelength

SEP 2
Developing and Using Models

Cause and Effect: Mechanism and Explanation

Bouncing balls make sound

Energy changes

Energy is transferred from place to place as the same form of energy

Energy can be transformed from one form to another (e.g., mechanical to sound)

Sound is caused by vibrations

Sound can be described by pitch and volume

Wave frequency and amplitude affect pitch and volume

SEP 3
Planning and Carrying Out Investigations

SEP 4
Analyzing and Interpreting Data

Cause and Effect: Mechanism and Explanation

Light travels

Light transfer energy from place to place

Light travels in a straight line

Light can be transmitted, absorbed, or reflected

Humans see due to light reflected off objects

Lght energy can be engineered to be used by humans

SEP 3
Planning and Carrying Out Investigations

SEP 4
Analyzing and Interpreting Data

SEP 2
Developing and Using Models

SEP 6
Constructing Explanations and Designing Solutions

Cause and Effect: Mechanism and Explanation

Energy and Waves

Grade 4th

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- Lakeside Union School District
- San Diego State University
- Santee School District

Regional Partnerships:

- Classroom of the Future
- Lakeside River Park Conservancy
- Padre Dam
- San Diego Gas and Electric
- San Diego County Office of Education
- San Diego Science Alliance
- San Diego State University Coastal and Marine Institute
- Tri County Drilling Company
- Webb Cleff Architecture (WACEE)

Unit Reviewers:

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Table of Contents

Grade 4

Physical Science: Energy and Waves

Introduction and Storyline

Introduction: IDEAS2.0 is a CA Math Science Partnership grant focused on incorporating the science and engineering, as well as the mathematical practices into science lessons in the elementary grades. The units were developed to help elementary teachers recognize how the science, engineering and mathematics practices drive instruction to build student understanding. The units align with the NGSS by addressing phenomenon, disciplinary core ideas and science and engineering practices. Crosscutting concepts were not a part of IDEAS2.0, and are not emphasized in the lessons.

In this unit, students explore energy as a wave that has amplitude and wave lengths. They investigate how energy can be changed (transferred and transformed) producing sound and light. They learn how to manipulate the properties of light for human use in making a periscope.

Anchor Phenomenon: Fireworks and Thunder and Lightning

In this unit, students explore energy as a wave that has amplitude and wave lengths. They investigate how energy can be changed (transferred and transformed) producing sound and light. They learn how to manipulate the properties of light for human use in making a periscope.

Investigative Phenomenon: Buoy/Surfers Bobbing in Water

Lesson 1 Buoy in the Water

This lesson is an introduction to energy. Students will reveal their prior knowledge about energy and begin to explore energy as a wave.

Lesson 2 Jump Ropes

In this lesson, students use jump ropes to further investigate how energy moves in a wave, but matter stays in place.

Lesson 3 Slinkies

In this lesson, students use slinkies to further investigate how energy moves in a wave, but matter stays in place.

Lesson 4 Labeling a Wave

Using waves in a tub of water, students create a wave on construction paper. They compare this model to their notebook drawings from Lesson 2 and 3, and label the parts of a wave in their model.

Investigative Phenomenon: Bouncing Balls Make Sound

Lesson 5 Energy Changes

In this lesson, students begin to explore that wave energy can be transferred by measuring bouncing balls and finally that energy can be transformed as mechanical energy is transformed to sound energy.

Lesson 6 Sound Waves

Students continue to learn about how mechanical energy is transformed into sound energy, measured with an iPad sound meter.

Lesson 7 Good Vibrations

Through investigations and video, students learn how wave frequency and amplitude affect pitch and volume.

Lesson 8 Perfect Pitch

Students build drums and guitars to explore how different instruments make sounds with different pitches. They order the instruments based on pitch using both their models and the iPad Sound meter.

Lesson 9 Fireworks

Fireworks are used as a phenomenon to connect sound and light. In this lesson students discuss how energy is transferred and transformed in a firework display.

Investigative Phenomenon: Light Travels

Lesson 10 Light Travels in a Straight Line

In this lesson, students begin to understand that light is energy that travels in a wave and that light rays travel in a straight line.

Lesson 11 Light Waves can be Transmitted or Absorbed

Students recall and use their prior knowledge (from grade 1) about how light is transmitted or absorbed using different materials.

Lesson 12 Light can be Reflected

Using mirrors, students conduct an investigation about how light is reflected.

Lesson 13 I Can See

In this lesson, students use their understanding that light is reflected to explain how humans see objects.

Lesson 14 Up Scope

The unit concludes with this lesson as an engineering application of waves and how reflected light waves can be used to build periscopes.

4.6 Sound Waves

Lesson Concept Sound waves travel and cause vibrations of molecules which causes sound.

Link In the previous lesson, students analyzed and interpreted data to learn that energy can be transferred and were introduced into energy transformation. In this lesson, students continue to learn about how mechanical energy is transformed into sound energy. In the next lesson, students learn about pitch and volume related to frequency and amplitude.

Time 60 minutes

Materials Whole Class

______Bill Nye video http://nicertube.com/5d2kjscx

Per groups of 4

1 Slinky

1 iPad

Per individual

Science Notebook

Pencil

Advance Preparation

1. Find space in the room to set up the slinkys
2. Play the video to make sure it works.

Procedure

Engage (5 minutes) Obtaining information

1. Ask students to go review their notebook drawings from when they made a model of a wave (jump rope and slinky).
2. Ask them to recall with a partner what their model described.
3. Point them to the side to side movement of the slinky and explain that today they will put energy into the slinky in a different way to see what happens.

Explore (10 minutes) Conduct an investigation to see how sound waves are made.

4. Ask students to get in groups of 4 and decide who will be the holder (2 students will do this); the recorder, and the ipad videographer.

5. Assign groups to their location. Have the holders spread the slinky on the floor, holding firm at one end and leaving a little slack at the other end. Then ask one student to gather up a few coils toward them on the slack end, and let go.
6. Have students practice and when they are ready, ask students to set up the investigation: holders in place, recorder ready to observe and ipad ready to video. Have them make 3 trial runs.
7. Ask students to sit back at their table and review what the recorder noted and what the *iPad video shows.
8. Ask students to draw what they observed in their notebook.

Explain (10 minutes) Obtain information to see how sound waves are made.

9. Show the video: http://nicertube.com/5d2kjscx and ask students to take notes on what they see.
10. Conduct a discussion of what the students noted in the video. Have them compare their observations of their slinky with what they noted in the video. How did the vibrations occur?
11. Ask students to draw a "compression" wave in their notebook. Label what moves and what stays in place.
12. Ask students to discuss how this wave relates to the jump rope or other slinky--what represents the tape in the compression wave and is "bobbing?" (air molecules) what is moving (the energy)

Evaluate (5 minutes) Sound waves cause vibrations.

13. Have students write an exit slip to answer this prompt: How did the bouncing balls from the previous lesson make sound?

Invasion!
(Of the Species)

Who are these invaders?

How will we deal with them?

Who will you enlist to help!

Table of Contents

- Overview Details
- Project Elements
- Science Elements
- Math Elements
- ELA Elements
- Elective Elements
- Additional Resources

- What makes some invasive species more of a problem than others?
- What ways can we determine which invasive species are worse than others in a given ecosystem?
- How does system thinking help us to understand the effect of invasive species?

Your Task: A call to action for citizens.

DEAL WITH THIS INVASIVE SPECIES!

Project Title: Invasion! (of the species)

Grade	*7th grade CA. Standards*
Guiding Questions	What makes some invasive species more or a problem than others? What ways can we determine which invasive species are worse than others in a given ecosystem? How does system thinking help us to understand the effect of invasive species?
Public Product	Create a presentation to highlight some troublesome invasive species in our area. Of those mentioned, describe one that is most troublesome, describe how you came to that conclusion and suggest a course of action to deal with it.
Big Idea	System thinking is important for understanding much of the natural world as well as the interpersonal world of humans. Exploring the issue of invasive species provides a great way for students to understand what it means for a system to be stable as well as how affecting one element of a system has an effect on other parts. **In this Project, students will** Learn about invasive species, the mathematics of predicting population growth and analysis of informational text as they build towards proposing some action to help mitigate the effects of a specific invasive species.
Background	Systems and systems thinking provide a nice opportunity for 7th grade students to begin to use more abstract and complex thinking. The cross-curricular connections in this PBL allow for leveraging context and content between classes. For example, comparing different proportional growth models in math is much more engaging when it is about comparing the population growth rate of two invasive species under investigation.
Student Work	Students will compare population growth of different species (math), write informational pieces about the topic of regulations that are meant to mitigate or minimize the effects of invasive species (ELA) and explore the effects on an ecosystem of invasive species (science). Students will also take part in a classic debate on topics related to invasive species and management of ecosystems.
Time Frame	*Predicted time frame: 2-3 weeks.*

Essential Design Elements

Sustained Inquiry	Each new subject area asks a different question. ELA asks about more societal issues and policy. Math ask students, "what does it mean to be 'more invasive'?" Science asks how one can measure or control the effects of invasive species on an ecosystem.
Authenticity	This project is more personal when students meet people who work with ecosystems and have the opportunity to ask about invasive species. This subject is part of a greater societal issue of weighing man's needs or desires and the needs of the greater system in which we live. Although this is not about human impact, this sets the stage for that conversation later in a real context from their local ecosystem(s).

	•Students do authentic work by being required to research and make decisions in the way concerned adults, professionals and activists do.
Student Voice & Choice	Students choose which species to compare and during the debate put together their own arguments for both sides to be the most persuasive.
Reflection Critique & Revision	Student work will regularly be subject to peer review in ELA. As they near the debate they use the knowledge from all three classes to evaluate and arguments.
Kick off/ Launch Event?	Show extreme cases of invasive species such as the pythons in Florida and zebra mussels in waterways to begiun the discussion of invasive species and the role of humans in changes to the environment and in controlling for change caused by invasive species.
How will support personnel be utilized:	

Project Design Rubric

Science

Link to Conceptual Flow

Summary of science concepts/topics explored in this project	**Standards:** MS-LS2-1: Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem. MS-LS2-2: Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems. MS-LS2-3: Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem. MS-LS2-4: Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations. MS-LS2-5: Evaluate competing design solutions for maintaining biodiversity and ecosystem services.
Performance Expectations/Possible Artifacts for analysis of student understanding	•Students will use data and textual resources to develop a model that describes relationships and interactions within an ecosystem as well as the effects of changes to an input or resources of an ecosystem. They will also develop arguments based on evidence to compare different invasive species in terms of the effect on an ecosystem. •Students will connect work done in math class to explain or predict concepts related to population growth or decay. •Students will design solutions for mitigation or even eradication of invasive species. For the project this will take the form of a proposal that will be presented.

Describe a sub-section of your content unit (also approximate time). You can merge or unmerge cells to show relative length to other content area sections (Highlight the cells then go to Table - unmerge cells)

Lesson Resource Links: INvasive species online game: https://educators.brainpop.com/lesson-plan/invasive-species-lesson-plan-the-invasion-game/

Math

Link to Conceptual Flow

Summary of math concepts/topics explored in this project	Converting a proportional relationship into an equation or graph helps us to make predictions beyond available data. A constant of proportionality describes the rate of change (growth) in a relationship. When representing a real world situation, each point, (*x, y)* represents a specific part of that relationship. Given a proportional relationship, the graph will pass through the origin (*0, 0*) and the point (*1, r*) where *r* is the unit rate. Two proportional relationships can be compared at single data points or (if time is a variable) over time. A comparison of their unit rate is also useful in describing how *y* will change as *x* increases. **7.RP.1, 7.RP.2**
Performance Expectations/Possible Artifacts for analysis of student understanding	A student may explore various methods and representations to describe population growth or compare the growth of two different species. As a PBL, students need to be working towards the *best* way to represent or describe part of this quest. This means they may choose to represent more than one way. Students may realize that population growth would almost never be proportional. They will learn to "assume proportional growth pattern" in order to compare. Students will need to have presentations of some sort that describes what they are investigating or explaining and also clear explanation of how their graphs, equations, tables relate to what they are discussing.

Sample Math Conceptual Development Sequence for this PBL

What does it mean to be proportional? Determining whether a relationship is proportional or	**How does data on a table show a proportional relationship?** Recognizing and generating data	**What is a rate?** Exploring rates as a specific type of relationship.	**What are examples of rates in the real world?** Applying the concept of proportional	**What are the ways we can describe a rate?** Unit rates.	**What is scale factor?** Scale factor in drawings.	**What is the relationship between unit rate and scale factor?**	**what are the best ways to compare two different relationships?** Apply unit rate, proportional

not	for proportional relationships		relationships				growth, graphing a proportional relationship, making predictions.

Lesson Resource Links:

ELA/Humanities

Link to Conceptual Flow

Summary of ELA/Humanities concepts/topics explored in this project	Informational Text. Students will read various informational text pieces to become familiar with societies struggle to balance our use of land and dealing with unintended side effects such as invasive species changing an ecosystem.
Performance Expectations/Possible Artifacts for analysis of student understanding	Students will produce writing that informs the audience about an issue related to invasive species. Studewnts will also prepare for, take part in and judge a debate on invasive species issues.

Describe a sub-section of your content unit (also approximate time). You can merge or unmerge cells to show relative length to other content area sections (Highlight the cells then go to Table - unmerge cells)

Lesson Resource Links:

Electives

Link to Conceptual Flow

Summary of electives concepts/topics explored in this project	

Performance Expectations/Possible Artifacts for analysis of student understanding	

Describe a sub-section of your content unit (also approximate time). You can merge or unmerge cells to show relative length to other content area sections (Highlight the cells then go to Table - unmerge cells)

Lesson Resource Links:

Sample ELA Content Map put together by a teacher team for this project:

Anchor Standards
(start on page 9)

What should an exiting 7th grader know about Informational Text?

All things have structures & observable patterns.

- Informational text is written to inform/explain a topic.
  - The structure, purpose, and context of informational text can be recognized.
    - Informational text has a purpose.
      - The purpose of informational test is to gain knowledge and information.
        - Informational text on the same topic can have different tones and/or biases.
        - Author's convey information using different structures.
        - Informational text is nonfiction.
      - Curiosity of topic helps develop greater understanding of information presented.
    - Reading informational text has a structure.
      - There are connections between running text & text features because they help convey meaning.
        - Informational text takes many forms, such as essays, articles, report, textbook.
        - Text features have a purpose to help readers comprehend text & determine main ideas.
      - Thesis statements, sub-thesis statements, and writer's analysis can be identified. R1/2
        - These are main ideas & details in informational text.
        - Effective transitions can be identified.
        - A topic sentence helps identify main idea.
      - Statements can be supported with evidence from text to establish relevance. R1
        - Informational text does not include opinion or personal statements.
        - Notes about main ideas are written in the writer's own words. R2
        - Informative writing uses evidence from a credible source(s). R3
  - Informational writing has a structure.
    - Informational text is the application of main idea and details in a specific structure and a logical format.
      - Essays need to contain correct content and structure for academic writing.
        - Essays need to contain correct context and structure for academic writing
        - Effective text features can be written/created to enhance reliability.
        - Varied sentences can be created including compound, complex, interrogative, etc.
        - Introductions have a clear structure.
        - Informative writing has a thesis
        - Body paragraphs are developed based off notes chart from readings
        - Conclusions have a clear structure
      - Writers know their purpose for writing which comes from a prompt.
        - Deconstruct prompt.
        - Demonstrating a prompt helps a writer stay focused and organized.
        - Answer the questions.
        - Create a note chart.
        - Analyze text features.
      - Writers use stylistic choices to convey meaning.
        - Audience and purpose must be considered in informational reading and writing
        - Writers can initiate other writers to practice different styles.
        - Active voice provides a format for conveying meaning in informational text
    - Information from a variety of sources can be integrated into informational writing.
      - Writers use stylistic choices to convey meaning.
      - Details from the text can be cited for use as evidence in written responses.
      - Sources are cited in functional essays.

Performance Expectation: Students support their statement with evidence from credible sources to establish relevance in order to inform/explain a topic.

6-12

College and Career Readiness Anchor Standards for Reading

The grades 6-12 standards on the following pages define what students should understand and be able to do by the end of each grade. They correspond to the College and Career Readiness (CCR) anchor standards below by number. The CCR and grade-specific standards are necessary complements—the former providing broad standards, the latter providing additional specificity—that together define the skills and understandings that all students must demonstrate.

Key Ideas and Details

1. Read closely to determine what the text says explicitly and to make logical inferences from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text.
2. Determine central ideas or themes of a text and analyze their development; summarize the key supporting details and ideas.
3. Analyze how and why individuals, events, and ideas develop and interact over the course of a text.

Clovis USD Coaching Form - Fall 2016

This form is to be completed by two observers at the end of the debrief of one lesson study cycle. The observers use a 4-point scale, never, seldom, sometimes, often. The responses are based on observations from the lesson planning, teaching of the lesson, and the lesson debrief.

1. **Observer**
   Mark only one oval.
   - CSUF Faculty
   - FCOE Coach
   - CUSD Coach

2. **Date**

   ____

3. **Cohort of Lesson Observed**

   ____

A. Expectations of Lesson Study

4. **1. To what extent did the lesson provide teachers the opportunity to expand on their use of questioning strategies to better understand student thinking?**
   Mark only one oval.
   - Never/limited
   - Seldom/beginning to include
   - Sometimes included
   - Included often or throughout

5. **2. To what extent did the lesson allow teachers to incorporate student responses as evidence of student understanding?**
   Mark only one oval.
   - Never/limited
   - Seldom/beginning to include
   - Sometimes included
   - Included often or throughout

6. **3. To what extent did the lesson allow teachers to incorporate student work as evidence of student understanding?**
Mark only one oval.

- Never/limited
- Seldom/beginning to include
- Sometimes included
- Included often or throughout

B. Planning the Lesson

7. **4. To what extent did the lesson utilize inquiry or problem solving oriented teaching strategies?**
Mark only one oval.

- Never/limited
- Seldom/beginning to include
- Sometimes included
- Included often or throughout

8. **5. To what extent did the lesson provide opportunities for students to learn from real-world situations to understand new concepts and skills with little teacher direction?**
Mark only one oval.

- Never/limited
- Seldom/beginning to include
- Sometimes included
- Included often or throughout

9. **6. To what extent did the lesson allow students to struggle and persevere with difficult problems?**
Mark only one oval.

- Never/limited
- Seldom/beginning to include
- Sometimes included
- Included often or throughout

10. **7. To what extent did the lesson utilize tasks that encourage students to develop and use models and/or use multiple strategies?**
Mark only one oval.

- Never/limited
- Seldom/beginning to include
- Sometimes included
- Included often or throughout

C. Observations

11. **8. To what extent did the lesson provide the opportunity for teachers to monitor student understanding in a collaborative setting?**

Mark only one oval.

- Never/limited
- Seldom/beginning to include
- Sometimes included
- Included often or throughout

12. **9. To what extent did the lesson contain built in check points for teachers to monitor students understanding of concepts and the application of skills?**

Mark only one oval.

- Never/limited
- Seldom/beginning to include
- Sometimes included
- Included often or throughout

13. **10. To what extent did the lesson contain components focused on both content and student collaboration?**

Mark only one oval.

- Never/limited
- Seldom/beginning to include
- Sometimes included
- Included often or throughout

14. **11. To what extent was the lesson successful in promoting a student-centered approach to facilitate learning for ALL students?**

Mark only one oval.

- Never/limited
- Seldom/beginning to include
- Sometimes included
- Included often or throughout

15. **12. To what extent did the lesson utilize inquiry or problem solving oriented teaching strategies?**

Mark only one oval.

- Never/limited
- Seldom/beginning to include
- Sometimes included
- Included often or throughout

16. **13. To what extent did the lesson provide opportunities for students to learn from real-world situations to understand new concepts and skills with little teacher direction?**
Mark only one oval.

- Never/limited
- Seldom/beginning to include
- Sometimes included
- Included often or throughout

D. Discussion and Revision

17. **14. To what extent were discussions guided by key questions related to the theme, goals, and standards?**
Mark only one oval.

- Never/limited
- Seldom/beginning to include
- Sometimes included
- Included often or throughout

18. **15. To what extent did discussions focus on the student learning in the lesson?**
Mark only one oval.

- Never/limited
- Seldom/beginning to include
- Sometimes included
- Included often or throughout

19. **16. To what extent did discussions include implications for future instruction?**
Mark only one oval.

- Never/limited
- Seldom/beginning to include
- Sometimes included
- Included often or throughout

E. Teacher Content Knowledge

20. **17. To what extent did the teachers extend or deepen their own mathematics content knowledge, understanding, and/or skills?**
Mark only one oval.

- Never/limited
- Seldom/beginning to include
- Sometimes included
- Included often or throughout

21. **18. To what extent did the lesson study team choose or develop problems that promoted the use of multiple strategies?**

Mark only one oval.

- Never/limited
- Seldom/beginning to include
- Sometimes included
- Included often or throughout

Open Ended Response

22. **19. What were some successes the team experienced?**

23. **20. What are the next steps for this team?**

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CMSP Coaching Reflections

* Required

Teacher's Name *

Coach *

Date *

Month Day 2016

Professional Goal(s) the teacher worked on during the lesson *

Reflection of Progress on Professional Goal(s) *

Summary of Lesson *

Evidence of Student Learning *

Student Discourse *

	0	1	2	3	4	5	
Not Present	◯	◯	◯	◯	◯	◯	Students are leading most of the discussions and asking the majority of the questions

Evidence of Student Discourse

Was a STEM Talk Used? *

- ☐ No
- ☐ Yes, Science
- ☐ Yes, Technology
- ☐ Yes, Engineering
- ☐ Yes, Mathematics

STEM Subjects Incorporated into Lesson *

- ☐ Science

- [ ] Technology
- [ ] Engineering
- [ ] Mathematics

Standards of Mathematical Practice Utilized in this Lesson

- [ ] Make sense of problems and persevere
- [ ] Reason abstractly
- [ ] Construct viable arguments and critique
- [ ] Model with mathematics
- [ ] Use appropriate tools strategically
- [ ] Attend to precision
- [ ] Look for and make use of structure
- [ ] Express regularity in repeated reasoning

Science and Engineering Practices Utilized in this Lesson

- [ ] Asking questions and defining problems
- [ ] Developing and using models
- [ ] Planning and carrying out investigations
- [ ] Analyzing and interpreting data
- [ ] Using math and computational thinking
- [ ] Constructing explanations and designing solutions
- [ ] Engaging in argument from evidence
- [ ] Obtaining, evaluating, and communicating information

Other Notes:

Submit

Never submit passwords through Google Forms.

Lesson Study Survey

One of our main goals with Project DELTA is to develop highly-qualified, highly- motivated, extraordinary teachers who will influence the way students learn mathematics. In our efforts to support teachers, it is important that you have a voice. As Cycle 1 of our Lesson Study comes to completion, we would like your input to evaluate and make adjustments for future cycles. Please take a few moments to provide your professional insight into the process. Please rate the following on a scale of 1-5.

Lesson Study Groups

	Strongly Disagree	Disagree	Indifferent	Agree	Strongly Agree
1. The group I participated in worked well as a group to collaboratively develop lessons.	1	2	3	4	5
2. The group I participated in worked well as a group to share responsibilities.	1	2	3	4	5
3. Group norms were created together.	1	2	3	4	5
4. Group norms are consistently adhered to.	1	2	3	4	5
5. Norms were reviewed at the beginning of each session.	1	2	3	4	5
6. Norms were reviewed at the end of each session.	1	2	3	4	5
7. At the end of each session we discussed which norm to focus on for the next meeting.	1	2	3	4	5
8. Our group used common core standards or standards from the framework to set concrete academic goals and measure achievement.	1	2	3	4	5
9. My group set a behavioral (affective) goal and used it to guide the planning of the lesson.	1	2	3	4	5
10. We looked at the research prior to planning our lesson.	1	2	3	4	5
11. The books from the Summer Institute were utilized in planning the group lesson.	1	2	3	4	5
12. The student data from blueprints, Inspect, etc. were used to determine specifics about the lesson design or focus.	1	2	3	4	5
13. Graphic organizers produced by the group were an important part of the lesson.	1	2	3	4	5
14. Teachers who observed the lesson made notes about student thinking and learning processes to use as a guide for critiquing the lesson.	1	2	3	4	5
15. Our group geared the lesson toward what students “should be able to do” and increased the rigor when we determined that students already knew the content.	1	2	3	4	5

16. On which days of your lesson study cycle did your group observe live lessons? (Bubble all that apply)

	1st Meeting	2nd Meeting	3rd Meeting	None
First observation:	Ⓐ	Ⓑ	Ⓒ	Ⓓ
Second observation:	Ⓐ	Ⓑ	Ⓒ	Ⓓ

	Strongly Disagree	Disagree	Indifferent	Agree	Strongly Agree
17. I would like to continue to observe the research lesson multiple times on the same day. (Answer only if your group observed the lesson more than once in the same day.)	①	②	③	④	⑤
18. At the conclusion of the lesson, each group member commented on the lesson and participated in the re-plan session.	①	②	③	④	⑤
19. Group comments were student-based and delivered in a professional manner, facilitating improvement for the lesson, rather than targeting individuals.	①	②	③	④	⑤
20. Our group offered positive comments, as well as helpful suggestions during de-brief sessions.	①	②	③	④	⑤
21. Our group adopted the philosophy that the purpose of teaching this lesson was to try out some things, not deliver a perfect product.	①	②	③	④	⑤

Math Content Specialist (MCS)

	Strongly Disagree	Disagree	Indifferent	Agree	Strongly Agree
22. The math content specialist (MCS) provided honest, insightful feedback.	①	②	③	④	⑤
23. The MCS guided the group through the process and helped hone the final product.	①	②	③	④	⑤
24. The MCS helped hone the final product.	①	②	③	④	⑤
25. The MCS encouraged crucial conversations and re-assessment after the lesson was conducted with students.	①	②	③	④	⑤
26. I feel safe to discuss concerns with the math lead.	①	②	③	④	⑤

Comments

	Strongly Disagree	Disagree	Indifferent	Agree	Strongly Agree
27. Lesson Study is a valuable component of the professional development I am receiving through Project DELTA.	①	②	③	④	⑤

Why or why not?

____

____

	Strongly Disagree	Disagree	Indifferent	Agree	Strongly Agree
28. As a teacher, I made a significant discovery during Lesson Study that will impact my pedagogy and future interactions with math students.	①	②	③	④	⑤

Please Share

____

____

	Strongly Disagree	Disagree	Indifferent	Agree	Strongly Agree
29. My group experienced success in the goal of incremental improvement.	①	②	③	④	⑤

Please Share

____

____

	Strongly Disagree	Disagree	Indifferent	Agree	Strongly Agree
30. I believe Lesson Study group time could be improved.	①	②	③	④	⑤

How?

____

____

	No	Yes
31. Did you teach any of the activities planned by your lesson study group in your own classroom?	①	②

If so, please share an example and your thoughts.

____

____

32. The thing I liked best about Lesson Study was…

____

____

Please indicate your group name below. This will help insure that we have feedback from all participants. The results of these surveys will be shared with Math Content Specialists however; the group names will not be shared.

Lesson Study Group Name ___________________________

Thank you so much for taking time to complete this survey. Your input will be carefully considered when planning for the next cycle.