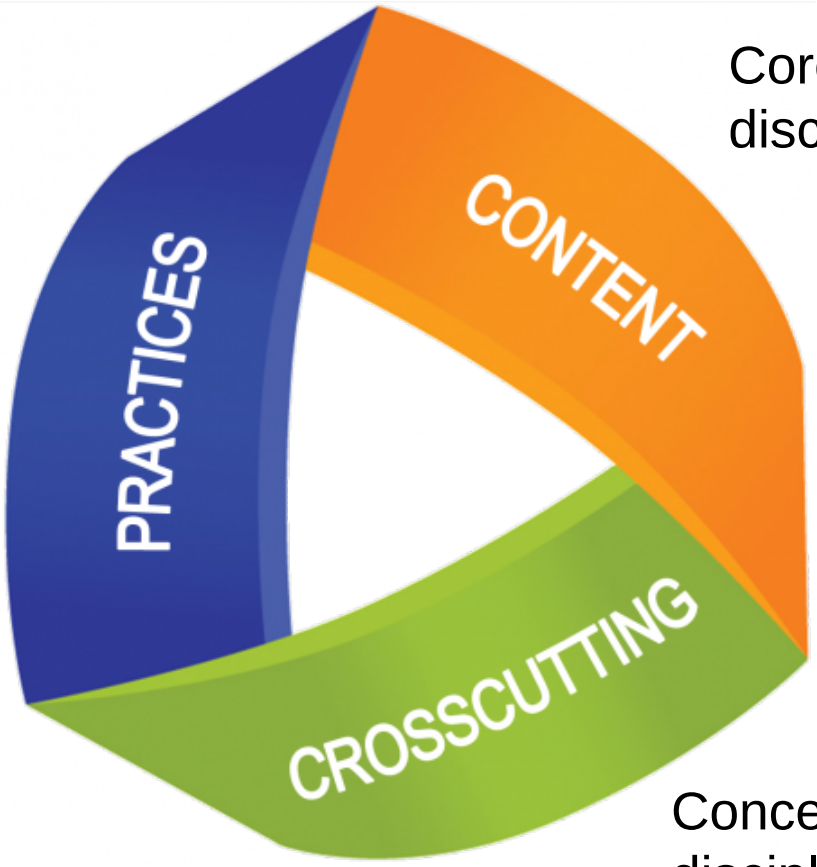
NGSS
Setting a New Course

CaNGSS
Middle School Conversation

Next Generation Science Standards

Core ideas in the discipline

Science and engineering



Concepts across disciplines

This figure represents the integration of science and engineering practices, core ideas in the content discipline, and crosscutting concepts across the disciplines.

California Science Expert Panel (SEP)

27 Science Experts who are representative of the SRT

- K-12 Teachers, COE Science Leaders, IHE Faculty, Business, Industry, and Informal Science Centers
- Noted Scientist Advisors
  - Dr. Bruce Alberts
  - Dr. Helen Quinn
  - Dr. Art Sussman

Path to MS Arrangement

Given:

- NGSS middle school in grade span
- NGSS as DCI or Topic arrangement
- CA instructional materials adoption dictates grade level placement

Path to MS Arrangement

Action:

- SEP #1: Explore arrangements;
  Decision to integrate

Dr. Art Sussman:

"…the SEP very seriously considered the option of having discipline-focused concepts for grades 6, 7 and 8. It quickly became very clear that there had to be foundational physical science concepts in grade 6 to be able to do the NGSS middle school life and earth science concepts. However some of the physical science concepts were clearly too advanced for grade 6 (required math concepts and skills that are beyond grade 6 level in addition to being too complex for grade 6). That combination of needing some physical science in grade 6 but not being able to do all physical science in grade 6 made the discipline-specific approach impossible.

What Research Says

- Iowa SS&C: Found significant positive differences in learning in science concepts, process, application, creativity, attitude, and world view of SS&C compared to non-SS&C students. Liu, C., & Yager, R. E. (1997)

- CA SS&C: Students in integrated biology scored the same or better than students in traditional biology on the Golden State Exam. Scott, G (2000)

Research Continued

Achieve examined 10 sets of international standards (i.e., Canada, Chinese Taipei, England, Finland, Hong Kong, Hungary, Ireland, Japan, Singapore, and South Korea), with the intent of informing the development of both the conceptual framework and new U.S. science standards. The major key findings include:

- Finding #1 - All countries require participation in integrated science instruction through Lower Secondary and seven of 10 countries continue that instruction through Grade 10, providing a strong foundation in scientific literacy. Achieve (2010).

Path to MS Arrangement

Action

- 3 Public Hearings support of integration

Path to MS Arrangement

SEP #2:

Set Criteria

Create Arrangements

Send to SRT

Criteria for Design

PEs must :

- Be arranged to provide a TRANSITION from elementary to high school
- ALIGN with CCSS ELA and Math
- Build WITHIN and ACROSS grade levels
- Be BALANCED in complexity and quantity at each grade
- INTEGRATE engineering appropriately

Path to MS Arrangement

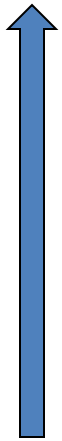
Action

SEP #3: Use input from SRT and National NGSS topics as a base to build a consensus arrangement

Dr. Bruce Alberts

"The [arrangement's] strong emphasis in the NGSS on cross-cutting concepts and on active learning has been enforced by mixing standards for the different sciences (and engineering) in each year of middle school. Thus, the students will reinforce what they learned the previous year, returning to related ideas, and the focus in every year will be on SCIENCE itself, not biology, or earth sciences, or the physical sciences."

Articulation One Example

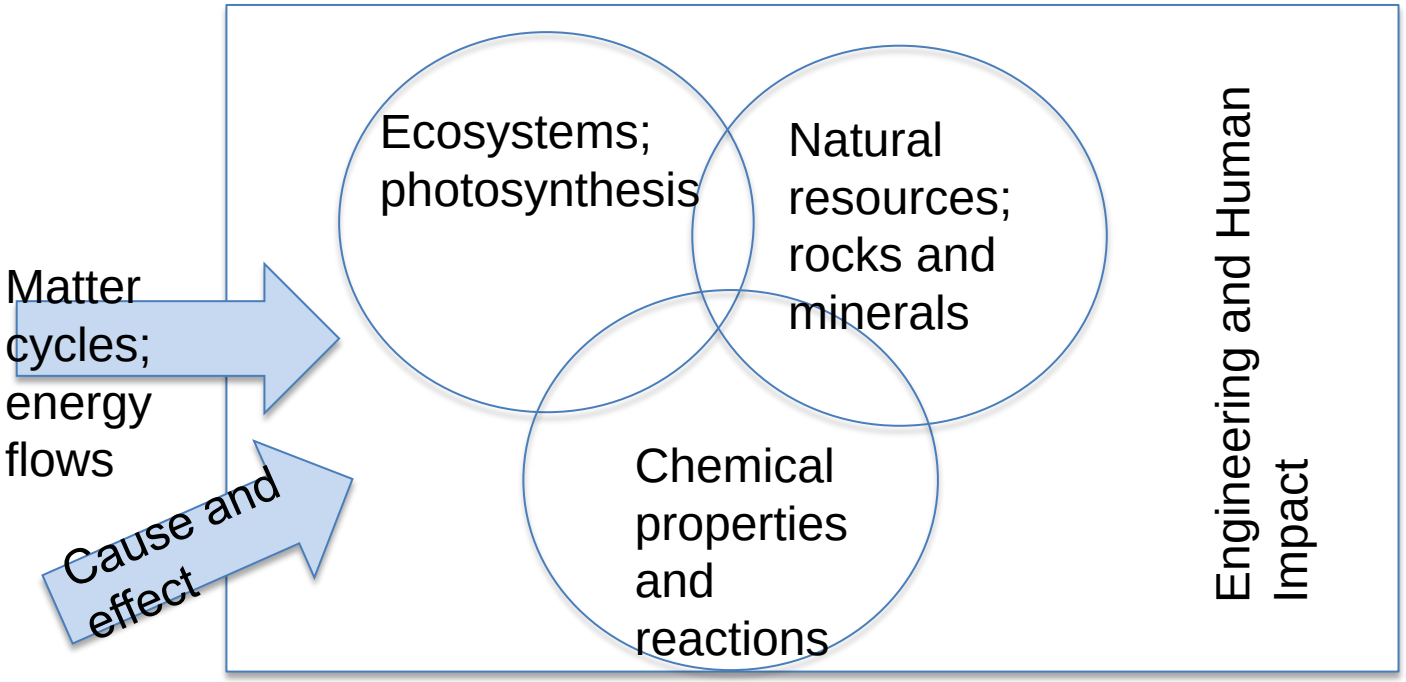


Life Science

- 8th Natural Selection
- 7th Ecosystems
- 6th Cells/Organisms

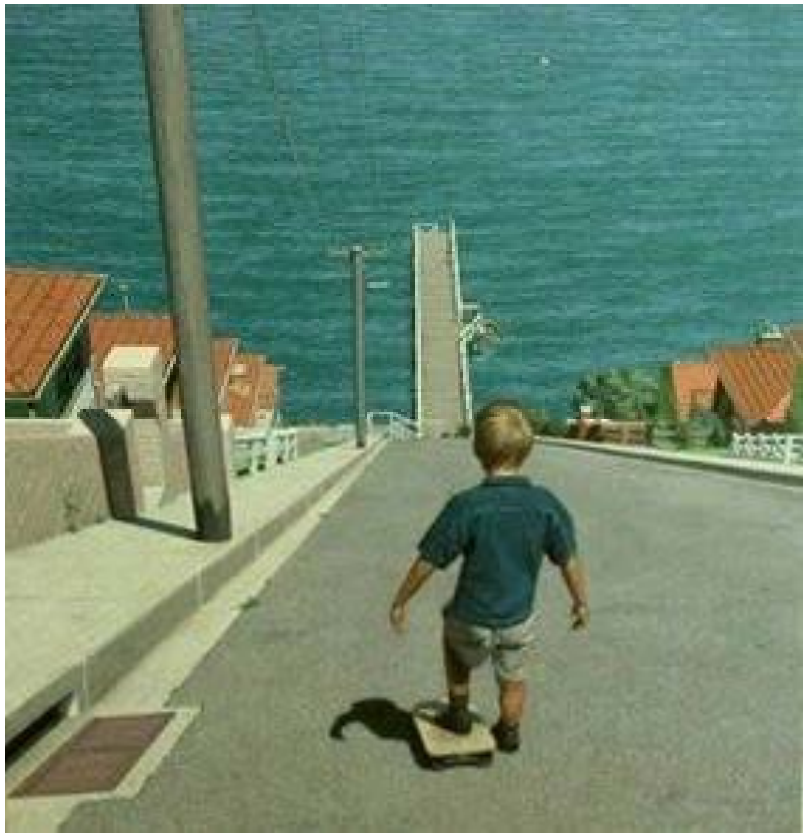
This figure represents the articulation in Life Science, where in 6th grade students learn about cells and organisms, ecosystems in 7th grade, and then natural selection in 8th grade.

Example Integration 7th Grade



This graphic represents the integration of Life, Earth and Physical science in 7th grade. The integration of ecosystems and photosynthesis, natural resources with rocks and minerals, and chemical properties and reactions. The theme of this graphic is matter cycles and energy flows. Cause and effect can be taught in this theme, as well as engineering and human impact.

And now it’s time



This image represents a child at the top of a steep hill, foot on a skateboard, about to roll down the hill towards a narrow pier, representing the excitement of a new adventure.

Pros of Two Choices

Discipline Specific

- Teacher Content Expertise
- Teacher Passion

Integration

- NGSS vision for science not silos
- Implementation of Cross Cutting Concepts
- Possibility of 8th grade integrated assessment
- Articulated Learning progression with LEPE each year
- SEP recommendation

Dr. Helen Quinn

"The recommended middle school sequence was developed with careful attention to many factors that will enhance student learning, as has been presented elsewhere. The evidence that such interleaved learning of topics, where past learning is connected to, applied and further developed in each subsequent unit or year provides the best opportunity for students to develop deeper understanding and transferrable, that is useable, knowledge. I strongly recommend that this sequence should be adopted. While it presents some challenges for teacher assignments it will in the long run be the most productive for in-depth student learning."

Creative Implementation

- Teach life, earth or physical 6th, 7th and 8th grade
- Combine expertise at grade level—students rotate; teachers stay in discipline
- Teachers collaborate to share expertise with colleagues
- Ease in implementation over the next several years
- State fully funds professional development!