Chapter 4 - Cross Cutting Concepts

- 7 but each needs to be taught explicitly
- 7 concepts embedded in all science instruction
- 7 cross cutting concepts (glue between the disciplines)
  - Patterns
  - Cause/effect
  - Patterns
  - Cause/effect
  - Scale/prop/quantity
  - Systems/models
  - Energy and matter
  - Structure and function
  - Stability
- End points (2^{nd}, 5^{th}, 8^{th}, 12^{th}) show where students should have an understanding at the end of a grade band
- Shows how cross cutting concepts interconnect the DCI's
- Identify and explain phenomena and patterns
- Explicit reference to multi-disciplinary concepts with engineering practices and science
- Progression of concepts
- Connects all learning – facilitates integration of all content areas
- Use of common language to help students connect language/concepts across disciplines
- Progression – reminds us and students that yesterday still matters today
- Provides linear and 3-Dimensional scaffolding (K-12)
- Across grade levels progression in complexity
- Fundamental to understanding
- Dramatic change is needed in assessment and instructional materials
- Interdependence of content areas
- Commonality and reinforcement of language (interdisc.)
- Ⓢ model, Ⓣ facilitate
- Backbone of science investigations
- Applicable to all science disciplines
- CC need to be made evident in instruction
- Common language PK-12

Chapter 5 - Physical

- Integrating chemistry and physics
- Core ideas address questions that students would likely ask themselves
- You can't miss an endpoint!
- 4 DCI's
- Cause/effect in all systems and processes
- What is everything made of
- Why do things happen
- Physical and chemical processes
- Interactions between objects – matter
- Forces
- Energy
- Waves
- Physics and chemistry
- "What is everything made of?"
- "Why do things happen?"
- Current chemistry is generally represented (gr 12 band)
- 4 core ideas across grade levels
- Info technology relies on the study and research
- Math (proportions are important)
- "By end of _____" endpoints for core ideas so there is a progression/foundation as students move through grades
- Recognizing connections between core ideas
- Matter, energy, and motion

Chapter 6 - Life Sciences	Chapter 7 - Earth & Space
• Concept-specific PD in genetics, molecular bio, and evolution • Shift from superficial topics to those covered at a deeper level • 4 DCI's • Not taught in isolation → 3 Dimensions taught together • For DCI, break down into several standards → Learning progressions 2nd, 5th, 8th, 12th (grade band endpoints) • Focus is on patterns, processes, and relationships of living organisms • Structure and function • Interactions of ecosystems • Heredity • Evolution • Evolution and its underlying genetic mechanisms of inheritance and variability are key to understanding • 4 core ideas for study • Human impact • Nature v. nurture – essential idea • 4 core ideas: (1) molec. → org (2) ecology (3) heredity (4) evolution • Progression that is scaffolded • Descriptions of core ideas rich with content • Evolution and heredity • Ecosystems and human impact • Structure and processes of living things	• Interconnected systems that change over time • Connection to other disciplines • Focus question under each concept • Core ideas o Earth's place in universe o Earth systems o Earth and human activity • Interconnected systems • Sources of energy within systems • Matter cycles within systems • Started with whole (universe) then focuses down to Earth, then human impact on Earth • Earth's relationship in space • Earth's systems (cycles) and geography and weather • Human impact on those systems (climate, nat. resources) • Human impacts on Earth's systems • How do we reconstruct and date events in Earth's history (not just to memorize but to understand) • Human impact • Emphasis on our place in the universe • Increasing relevance of ESS due to data collection from multiple technologies • Natural hazards more than an afterthought • Focus on human interaction with Earth in broader context • Interactive processes of Earth's "spheres" • Dynamic relationship between Earth and humans

Debriefing the Framework Chapters 4-10 and planning for the future
Common connections

- essential questions
- grade bands
- learning progressions
- cross cutting concepts
    - patterns
    - cause/effect
    - scale, proportion, quantity
    - systems
    - energy/matter
    - structure function
    - scalability
- all DCI's conceptual understanding of the specific discipline
- focus question with each DCI
- grade endpoints; learning progression 2^{nd}, 5^{th}, 8^{th}, 12^{th}
- small and consistent number of core ideas
- expectation of prior learning for new grade bands
- instruction moves towards higher order thinking
- greater focus on less concepts to improve scientific literacy
- building teacher content (K)
- interconnectedness → patterns
- each chapter establishes progression and continuity, scaffolding and benchmarks
- core ideas span grade levels
- interaction
- micro v. macroscopic
- small # of core ideas
- things evolve and change
- progression
- knowledge to help understand

Where do we need to go?

- PD → K-6 teachers → content support (lesson delivery, A.B.C., integration math and ELA)
- PD → 7-12 → networking – especially smaller districts, possible models – integration? Content and support
- Setup network for sharing resources, ideas; share ideas for using time in school day for communication K-12 (PLC?)
- Network setup OCM modeling lessons to show use of scientific and engineering practices (makes it less intimidating)
- "buy-in" K-12, community and professional support, time
- Our current reality sees that we teach facts/concepts in Isolation. A shift that we need to continue to work on is to integrate the 3 Domains and not just isolate DCI's. More experiential science instruction that is student centered to apply (CCC and Practices)
- Implement a more interdisciplinary approach (ELA/Science)
- We have to address the K-12 progression for vertical articulation and horizontal coherency (Curriculum, Assessment, and Instruction)
- Science Leadership can provide PD on NGS/NYSSLS
- Science Leadership can help bring to fruition development of Regional Curriculum Development

Debriefing the Framework Chapters 4-10 and planning for the future

- Science Center can help upper administration recognize the importance of Science Instruction, especially at the lower levels (refer to LASER study)
- Hurdles: (1) buy in for all (2) funding for PD
- Professional Development
- Concept and content driven with a focus on cross cutting concepts
- Have Science Leadership help determine the need at each level
- Science Center can provide support:
  - E-learning
  - Connections with Smithsonian and others
- Hurdle → teacher's fears → time → APPR
- Finding room for science in the instructional day (K-6)
  - Regional sharing of schedules (typical day) & ideas
  - Widespread sharing of data and studies that show how science education supports students' math and ELA learning
- Translating standards into curriculum into curriculum using both the Framework and the NYSSLS
  - PD on curriculum/units/lessons aligned to new standards
- Maintaining a coherent progression K-12
  - PD on "the big picture"
- What is assessment going to look like?
  - Sharing of exemplars/sample assessments K-12
- Consistent communication regarding implementation expectations (ie – elementary time frame)
- Needs assessment (district and regionally)
  - Content knowledge
  - Scope, sequence and alignment
- Targeted professional development based on needs assessment *implementation time
- Reflection and feedback on above → re-evaluate

<u>Engineering Practices Literacy</u>

- Reflects crosscutting concepts
- Turnkey trainers for districts
- Appropriate applications, materials, time

Debriefing the Framework Chapters 4-10 and planning for the future

Increased Promotion of Science by SED
- Elementary hamstrung
- ↑ K-12 communication
- Advocate @ state level
- APPR, time

Admin.-Teacher Buy-In (seeing the shift)
- New way of teaching
- Providing data, modeling
- PD for "NGSS Skeptics"
- Inertia, fear, time

Increase Communication PK-12
- A system change and knowing that it's working
- Sharing what's working, taking info back to district
- Simplify, break-down information, general PK-12 – then explode information per grade bands
- Time and structure for it to happen, implementation plan/timeline

Focus on Progressions
- Don't skip anything, describe mastery
- Sharing what's working, taking info back to district
- General PK-12 – ten explode information per grade band
- How many kids get UPK/PK time to collaborate, system for vertical collaboration, complexity of document

PD on the Basics
- Common Understanding – we aren't doing this yet!
- Sharing what's working, taking info back to districts
- Have PD and outlines that are grade band specific, virtual module (stipend)
- Sub shortage, finances, time, implementation plan/timeline

Access to resources (Materials, Text, Equipment)
- Provide for absences and different learning modalities (Anchor, starting point)
- Sharing what's working, taking info back to districts
- Provide resources, database of resources
- Getting educators to use resources with fidelity, finances

Chapter 10 (Top 4 things for the region next year…)
1. Updating practices for science instruction: how do we change our instruction to implement the new standards – internalize the personal changes needed
2. Prof. Dev. by grade level → on content → on pedagogy [rationale – build teacher "confidence"]
3. Emphasis on student discussion regarding science and engineering concepts → science literacy → inter-connectedness
4. "authentic" multiple forms of assessment