



# BSCS Science: An Inquiry Approach

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Understanding by Design:  
A Tool for Curriculum  
Development

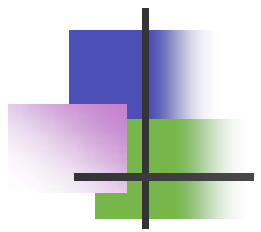


# BSCS Science: An Inquiry Approach

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- Our Multidisciplinary Framework
  - 6-11
  - Currently funded for 9-11
- Standards-Based
- Coherence, Rigor, Focus
- The BSCS 5Es

## BSCS Science: An Inquiry Approach, Grades 9-11 Framework



Units	Major Concepts Addressed at Each Grade Level		
	9	10	11
<b>Science as Inquiry</b>	Abilities necessary to do and understandings about scientific inquiry with a focus on:		
	<ul style="list-style-type: none"> <li>• Questions and concepts that guide scientific investigations</li> </ul>	<ul style="list-style-type: none"> <li>• Design of scientific investigations</li> <li>• Communicating scientific results</li> </ul>	<ul style="list-style-type: none"> <li>• Evidence as the basis for explanations and models</li> <li>• Alternative explanations and models</li> </ul>
<b>Physical Science</b>	<ul style="list-style-type: none"> <li>• Structure and properties of matter</li> <li>• Structure of atoms</li> <li>• Integrating chapter</li> </ul>	<ul style="list-style-type: none"> <li>• Motions and forces</li> <li>• Chemical reactions</li> <li>• Integrating chapter</li> </ul>	<ul style="list-style-type: none"> <li>• Interactions of energy and matter</li> <li>• Conservation of energy and increase in disorder</li> <li>• Integrating chapter</li> </ul>
<b>Life Science</b>	<ul style="list-style-type: none"> <li>• The cell</li> <li>• Behavior of organisms</li> <li>• Integrating chapter</li> </ul>	<ul style="list-style-type: none"> <li>• Biological evolution</li> <li>• Molecular basis of heredity</li> <li>• Integrating chapter</li> </ul>	<ul style="list-style-type: none"> <li>• Matter, energy, and organization in living systems</li> <li>• Interdependence of organisms</li> <li>• Integrating chapter</li> </ul>
<b>Earth-Space Science</b>	<ul style="list-style-type: none"> <li>• Origin and evolution of the universe</li> </ul>	<ul style="list-style-type: none"> <li>• Geochemical cycles</li> </ul>	<ul style="list-style-type: none"> <li>• Energy in the Earth system</li> <li>• Integrating chapter</li> </ul>
	<ul style="list-style-type: none"> <li>• Origin and evolution of the Earth system</li> <li>• Integrating chapter</li> </ul>	<ul style="list-style-type: none"> <li>• Integrating chapter</li> </ul>	
<b>Science, Technology, and Society</b>	<ul style="list-style-type: none"> <li>• Personal and community health</li> <li>• Natural and human-induced hazards</li> <li>• Abilities of technological design</li> </ul>	<ul style="list-style-type: none"> <li>• Population growth</li> <li>• Natural resources</li> <li>• Environmental quality</li> </ul>	<ul style="list-style-type: none"> <li>• Science and technology in local, national, and global challenges</li> <li>• Understandings about science and technology</li> </ul>
	History and Nature of Science addressed throughout grade levels and units <ul style="list-style-type: none"> <li>• Science as a human endeavor</li> <li>• Nature of science</li> <li>• History of science</li> </ul>		

Shaded areas indicate units developed in Phase I



# The BSCS 5Es

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- Engage
- Explore
- Explain
- Elaborate
- Evaluate



# What Was Our Approach?

## Year One

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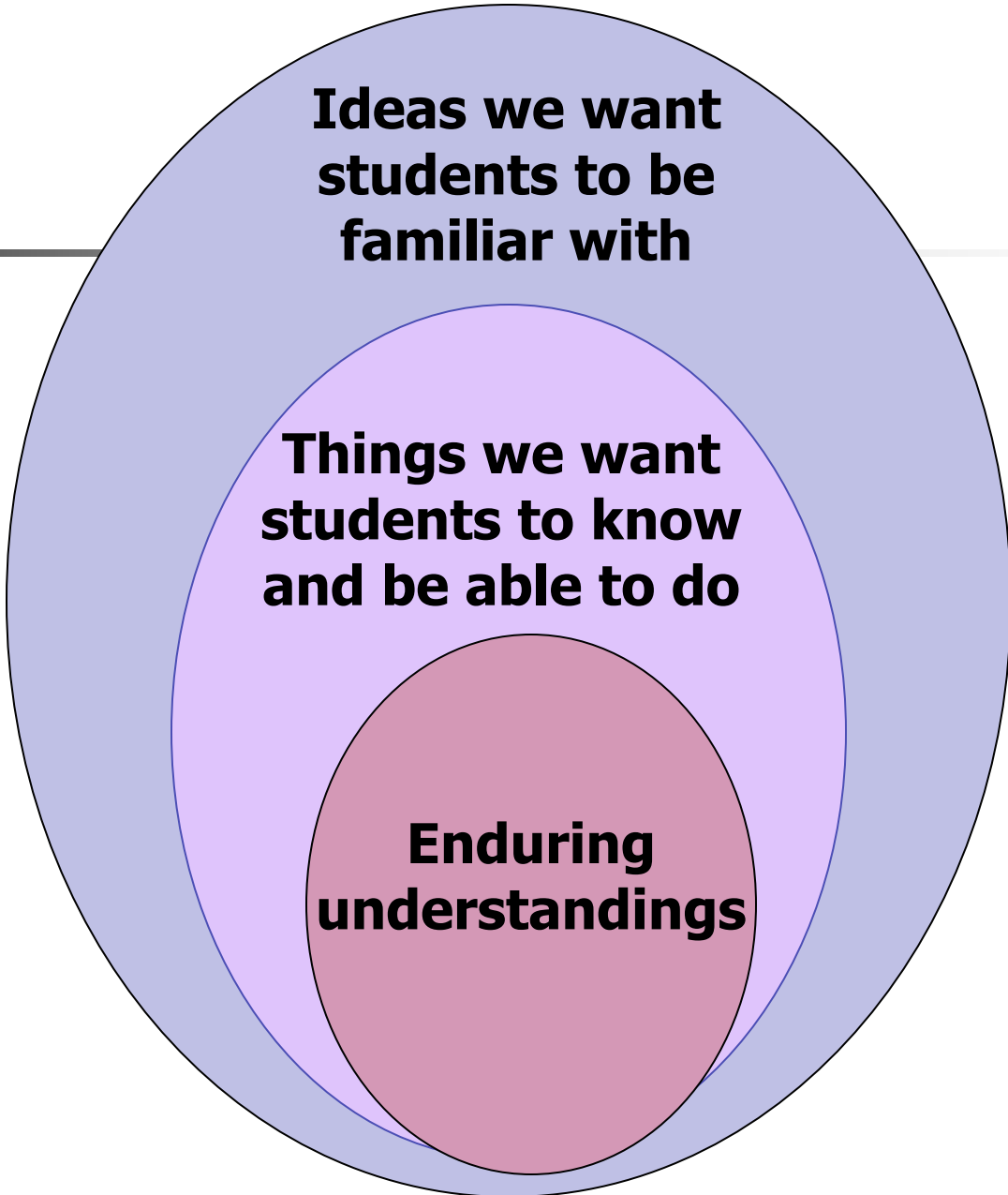
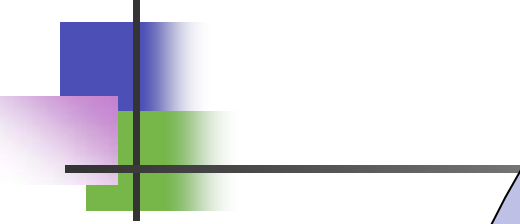
- Stage 1: What do we want students to learn?
- Stage 2: What will serve as evidence that they have learned?
- Stage 3: What learning sequence will ensure students' success?



# At the Unit Level

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- We reviewed the unit level standards and considered the flow across 4 chapters
  - Concept map of big ideas and connections
  - Enduring understandings--in the foreground
  - Essential questions--in the background



**Ideas we want  
students to be  
familiar with**

**Things we want  
students to know  
and be able to do**

**Enduring  
understandings**



# Characteristics of Essential Questions

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- Go to the heart of the discipline
- Recur naturally
- Provide compelling context for learning
- Raise other important questions
- Provide opportunities for making conceptual connections

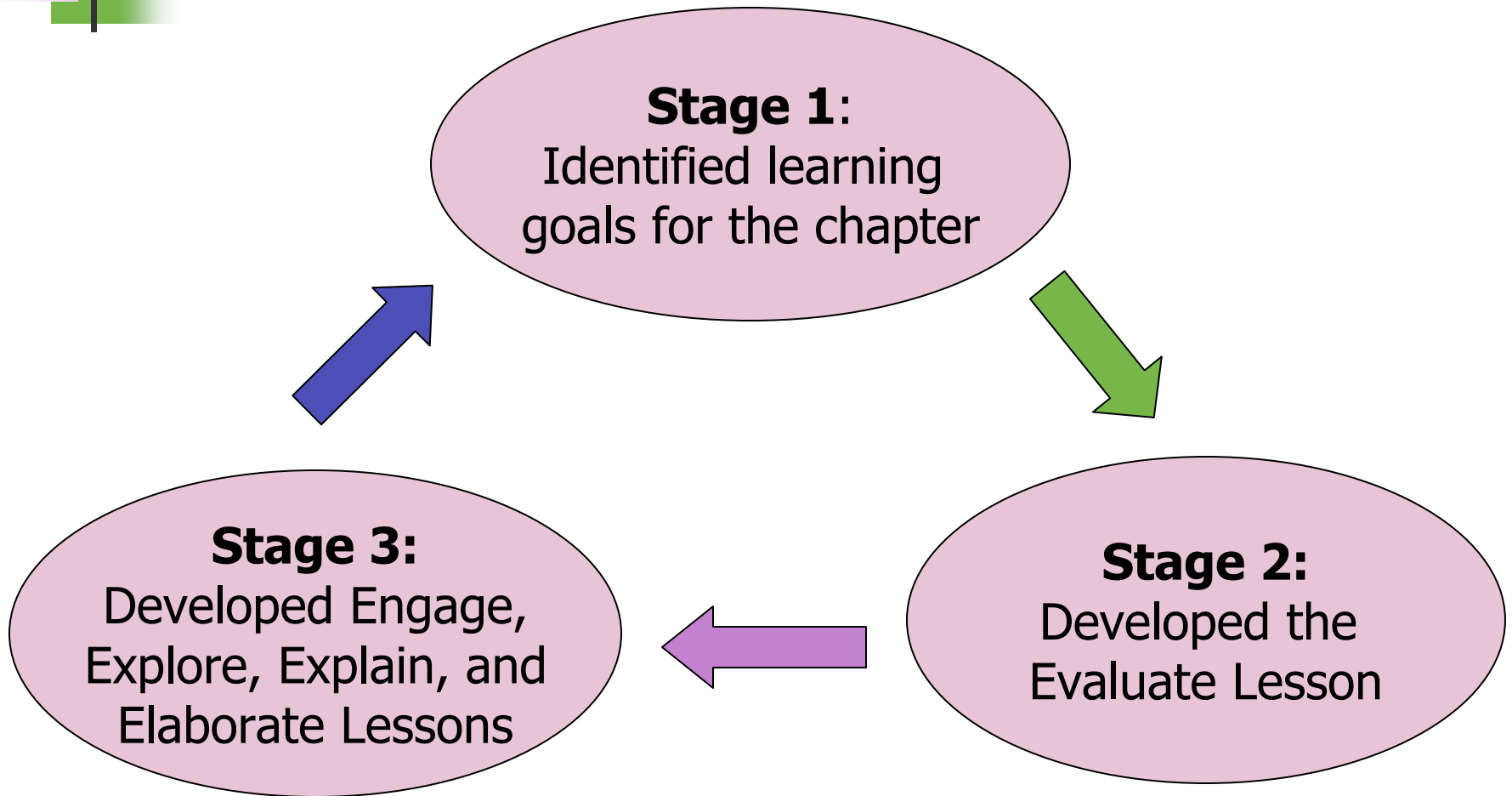


# At the Chapter Level

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- Stage 1: We identified the learning goals for the chapter.
- Stage 2: We developed the Evaluate lesson.
- Stage 3: We developed the Engage-Elaborate lessons.

# Understanding by Design At the Chapter Level

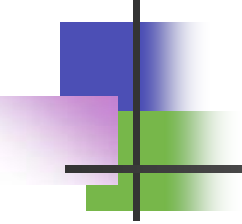




# For the Evaluate Lesson

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- Developed the general idea, context, scope of the lesson
- Wrote the Outcomes and Indicators of Success (Os and Is)
- Developed a comprehensive scoring rubric
- Wrote the Evaluate lesson with these as guides
- The process is iterative, messy, non-linear



# At the Lesson Level: Engage-Elaborate

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- Identified the purpose, context, and scope of the lesson
- Developed the Os and Is
- Wrote the lesson with the Os and Is as guides
- The process is iterative, messy, non-linear



# Learning As We Work: Year Two

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How did we use

- The Six Facets of Understanding
- Knowledge, Skills, and Understandings
- Characteristics of Essential Questions
- WHERE TO



# Six Facets of Understanding

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- Explanation
- Interpretation
- Application
- Perspective
- Empathy
- Self-Knowledge



# The 5Es and the Six Facets

<b>Engage</b>	<b>Self-knowledge, perspective, empathy</b>
<b>Explore</b>	<b>Perspective, interpretation</b>
<b>Explain</b>	<b>Explanation, perspective, interpretation</b>



# The 5Es and the Six Facets

<b>Elaborate</b>	<b>Application, Empathy</b>
<b>Evaluate</b>	<b>Self-knowledge, Others to the extent appropriate</b>



# Knowledge, Skills, and Understandings

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- Together knowledge and skills lead to understandings.
- This idea along with the six facets informed our Os and Is for each lesson.
- Carefully written Os and Is across the 5Es led to more focused, coherent chapters.



# Characteristics of Essential Questions

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Used to guide and assess the questions we developed in the lessons

- Go to the heart of the discipline
- Recur naturally
- Provide compelling context for learning
- Raise other important questions
- Provide opportunities for making conceptual connections



# Focus on the Questions

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- Are carefully selected
  - fewer in number
- Are logically sequenced
  - Well written



# WHERE TO: A Check

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- **W**here are we headed?
- **H**ook for students
- **E**xplore, Experience, Equip
- **R**efine, Rethink, Revise
- **E**valuate students' understanding
- **T**ailor for individual needs
- **O**rganize for effectiveness

How does this align with the 5Es?



# UbD and the Revision Process

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- Compelling tool for revising our FT materials
- Beginning to use UbD in the revision of other programs
- Used in conjunction with the AIM process
  - Analyzing Instructional Materials
    - A WestEd/BSCS Tool