A Framework for K-12 Science Education: Practices, Crosscutting Concepts and Core Ideas
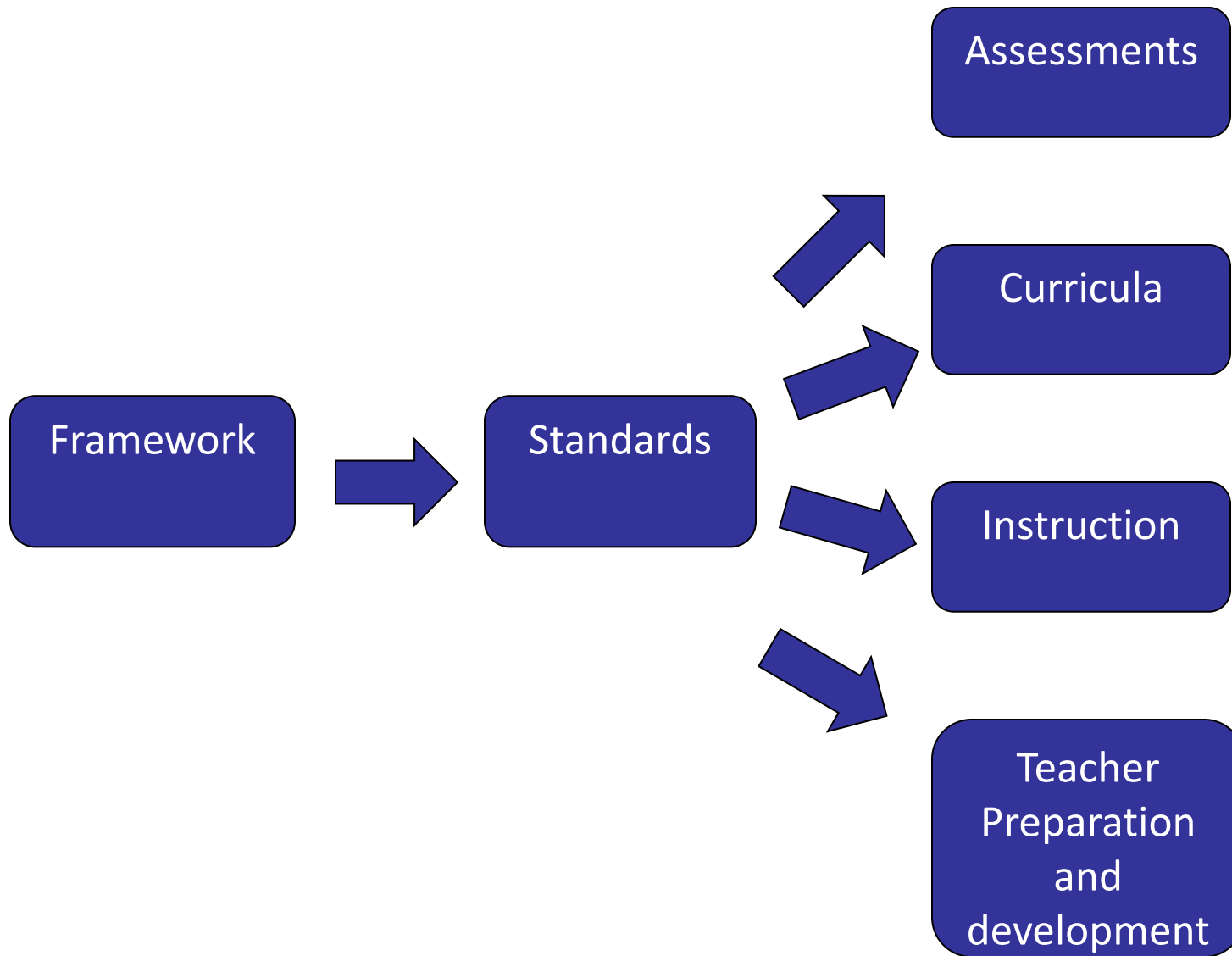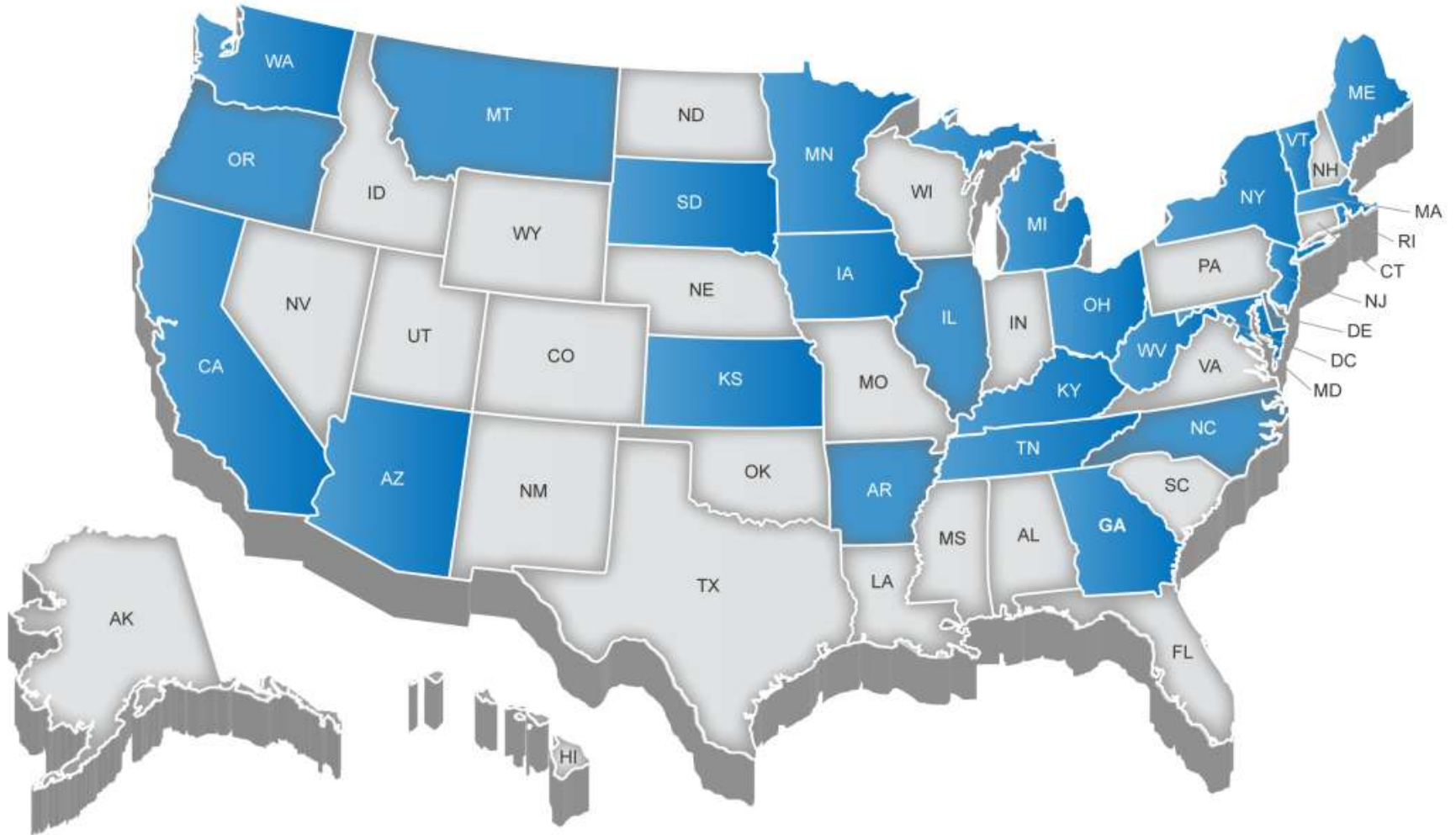
Board on Science Education

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NATIONAL RESEARCH COUNCIL
OF THE NATIONAL ACADEMIES

Framework → Standards → Assessments, Curricula, Instruction, Teacher Preparation and development

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Lead State Partners

Three Dimensions

- Scientific and engineering practices

- Crosscutting concepts

- Disciplinary core ideas

Goals of the Framework

- Coherent investigation of core ideas across multiple years of school

- More seamless blending of practices with core ideas and crosscutting concepts

Scientific and Engineering Practices

1. Asking questions and defining problems

2. Developing and using models

3. Planning and carrying out investigations

4. Analyzing and interpreting data

5. Using mathematics and computational thinking

6. Developing explanations and designing solutions

7. Engaging in argument from evidence

8. Obtaining, evaluating, and communicating information

Crosscutting Concepts

1. Patterns

2. Cause and effect: mechanism and explanation

3. Scale, proportion and quantity

4. Systems and system models

5. Energy and matter: flows, cycles and conservation

6. Structure and function

7. Stability and change

Disciplinary Core Ideas: Physical Sciences

- PS1 Matter and its interactions

- PS2 Motion and stability: Forces and interactions

- PS3 Energy

- PS4 Waves and their applications in technologies for information transfer

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Disciplinary Core Ideas:
Life Sciences

- LS1 From molecules to organisms: Structures and processes

- LS2 Ecosystems: Interactions, energy, and dynamics

- LS3 Heredity: Inheritance and variation of traits

- LS4 Biological evolution: Unity and diversity

Disciplinary Core Ideas:
Earth and Space Sciences

- ESS1   Earth's place in the universe

- ESS2   Earth's systems

- ESS3   Earth and human activity

Disciplinary Core Ideas:
Engineering, Technology and Applications of Science

- ETS1   Engineering design

- ETS2   Links among engineering, technology, science and society

Assessment challenges

- Assessing Practices

- Assessing big ideas and concepts (not memorized details)

- Multidimensionality

Rich multidimensional tasks Challenges

Reading complexity of task

Time to complete task

Cost to score task

Reliability of scoring