Science:
Linking the Preschool Learning Foundations with the California Kindergarten Science Content Standards

Focus Statement

Students become familiar with the California Department of Education's *Science Content Standards for California Public Schools, Kindergarten Through Grade Twelve* (California Department of Education, 2000) and explore their relationship to the science foundations in the *California Preschool Learning Foundations, Volume 3.*

Curriculum Alignment Project (CAP) Student Learning Outcomes

The Curriculum Alignment Project's (CAP) lower division eight courses and student learning outcomes are mapped onto each instructional guide learning experience. See Appendix A for the specific student learning outcomes, objectives, and examples of course content and topics for the courses listed below.

- Child Growth and Development
- Introduction to Curriculum
- Principles and Practices of Teaching Young Children
- Practicum-Field Experience

Instructional Methodologies

- Class discussion
- Development of resource tool
- Pairs or small groups
- Reflective discussion

California Early Childhood Educator Competency Areas to Consider

The Faculty Initiative Project will undertake a comprehensive process in the future to map the content of the instructional guides to the California Department of Education, Early Education and Support Division's *California Early Childhood Educator Competencies*. The "Competency Areas to Consider" below are listed in this instructional guide as a preliminary exploration of how particular competency areas might be addressed through these learning experiences.

- Child Development and Learning
- Learning Environments and Curriculum
- Leadership in Early Childhood Education
- Professionalism
- Administration and Supervision

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Before You Start

As stated on page 50 of the *California Learning Foundations, Volume 3*, the preschool learning foundations for the science domain are aligned with the *Science Content Standards for California Public Schools* (California Department of Education, 2000) and the *National Science Education Content Standards* (National Committee on Science Education Standards and Assessment and National Research Council 1996). In this learning experience, students can explore one or both of these documents and the relationship to the preschool science foundations. It will be important to recognize and to support students in understanding that one is a key California early learning resource and the other is a key national early learning resource.

Appendix B of the *California Preschool Learning Foundations, Volume 3* publication is "An Overview of the *Alignment of the California Preschool Learning Foundations with Key Early Education Resources*." This is a summary of an alignment document published by the California Department of Education that shows the alignment of all domains of the foundations to three other key California early learning resources, including the kindergarten content standards, and to the *Head Start Early Learning and Development Framework*. Table 12 on pages 159–160 shows the alignment between the science foundations at the strand and substrand levels and the kindergarten content standards, as well as to the *California Infant/Toddler Development Foundations*.

There is a learning experience in this instructional guide, titled "Exploring the Overview of the *Alignment of the California Preschool Learning Foundations with Key Early Education Resources*," that will support students in exploring all the alignment materials in Appendix B of the *California Preschool Learning Foundations, Volume 3* and guide them through the alignment of California foundations in all domains to the other three resources. Therefore, please keep in mind that this learning experience described in the "Active Learning" below relates only to the science foundations and how they are aligned to a specific California resource, *Science Content Standards for California Public Schools* (California Department of Education, 2000) and a specific national resource, the *National Science Education Content Standards* (National Committee on Science Education Standards and Assessment and National Research Council 1996).

Students will need access to the California science content standards, and instructors may choose to provide copies of the pages with the kindergarten standards or ask students to download the full document from the California Department of Education's Web site (http://www.cde.ca.gov/be/st/ss/index.asp). Please note that at the time the

California Preschool Learning Foundations, Volume 3 and this instructional guide were developed, the science content standards adopted by the California Board of Education in 1998 and published by the California Department of Education in 2000 were current. This version is listed under "Previous Content Standards" on the Web page.

If students are also to work with the *National Science Education Content Standards*, the document can be read online at http://www.nap.edu/openbook.php?record_id=4962&page=R1 or a PDF version can be downloaded at https://download.nap.edu/login.php?record_id=4962&page=/download.php?record_id=4962. Please note that one must register for a free account with The National Academies Press in order to download the document. The registration page is http://www.nap.edu/content/help/mynaphelp.html.

Two handouts, Handout 1 and Handout 2, which students can use in comparing the preschool science learning foundations with the California kindergarten science content standards and the *National Science Education Content Standards,* are included with this learning experience. Electronic versions of these handouts will be available when this instructional guide is online at www.wested.org/facultyinitiative.

Information Delivery

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Students are to review and compare two sets of materials in the initial part of this learning experience: the kindergarten content standards of the *Science Content Standards for California Public Schools* (California Department of Education, 2000) and the science foundations in the *California Preschool Learning Foundations, Volume 3*.

A summary of the science foundations can be found in Appendix B of this instructional guide as well as in the handouts of these science learning experiences in this instructional guide: Learning Experience 3, "Piecing Together the Science Domain Content Puzzle," and Learning Experience 4, "Exploring the Content and Vocabulary of the Science Domain."

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The following outline is a summary of the California kindergarten science content standards as adopted by the California State Board of Education in 1998:

Physical Sciences

1. Properties of materials can be observed, measured, and predicted. As a basis for understanding this concept:
   a. *Students know* objects can be described in terms of the materials they are made of (e.g., clay, cloth, paper) and their physical properties (e.g., color, size, shape, weight, texture, flexibility, attraction to magnets, floating, sinking).

b. *Students know* water can be a liquid or a solid and can be made to change back and forth from one form to the other.
c. *Students know* water left in an open container evaporates (goes into the air) but water in a closed container does not.

Life Sciences

2. Different types of plants and animals inhabit the earth. As a basis for understanding this concept:
   a. *Students know* how to observe and describe similarities and differences in the appearance and behavior of plants and animals (e.g., seed-bearing plants, birds, fish, insects).
   b. *Students know* stories sometimes give plants and animals attributes they do not really have.
   c. *Students know* how to identify major structures of common plants and animals (e.g., stems, leaves, roots, arms, wings, legs).

Earth Sciences

3. Earth is composed of land, air, and water. As a basis for understanding this concept:
   a. *Students know* characteristics of mountains, rivers, oceans, valleys, deserts, and local landforms.
   b. *Students know* changes in weather occur from day to day and across seasons, affecting Earth and its inhabitants.
   c. *Students know* how to identify resources from Earth that are used in everyday life and understand that many resources can be conserved.

Investigation and Experimentation

4. Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept and addressing the content in the other three strands, students should develop their own questions and perform investigations. Students will:
   a. Observe common objects by using the five senses.
   b. Describe the properties of common objects.
   c. Describe the relative position of objects by using one reference (e.g., above or below).
   d. Compare and sort common objects by one physical attribute (e.g., color, shape, texture, size, weight).
   e. Communicate observations orally and through drawings.

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Getting it started

This learning experience begins with the students reviewing the California preschool science foundations and the California kindergarten content standards. If this is the students' initial exposure to the science foundations, it may be helpful to spend some time discussing some of the examples for each foundation. Reviewing the glossary on pages 95–96 of the *California Preschool Learning Foundations, Volume 3* may also assist students in understanding the foundations.

Ask students to note the similarities and differences among the substrands and foundations of the three content strands—Physical Sciences, Earth Sciences, and Life Sciences. Discuss what each of the substrands and foundations for the Scientific Inquiry strand could look like for preschoolers, again drawing from the examples as necessary.

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Keeping it going

Next introduce Handout 1 or ask students to create a similar grid. Working individually or in small groups, students are to list any foundations that they believe are related to one or more of the kindergarten science content standards. For example, foundation 1.2 of the Scientific Inquiry strand, Observation and Investigation substrand is "Observe objects and events in the environment and describe them." This foundation could be listed under three elements of the Investigation and Experimentation kindergarten standard: "Observe common objects by using the five senses," "Describe the properties of common objects," and "Describe the relative position of objects by using one reference (e.g., above or below)."

Investigation and Experimentation			
4. Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept and addressing the content in the other three strands, students should develop their own questions and perform investigations. Students will:			
	a. Observe common objects by using the five senses.	b. Describe the properties of common objects.	c. Describe the relative position of objects by using one reference (e.g., above or below).

	Strand(s), substrand(s), & foundation(s):	**Strand(s), substrand(s), & foundation(s):**	**Strand(s), substrand(s), & foundation(s):**
	Strand – Scientific Inquiry Substrand - 1.0 Observation and Investigation Foundation – 1.2, 48 and 60 months of age	Strand – Scientific Inquiry Substrand - 1.0 Observation and Investigation Foundation – 1.2, 48 and 60 months of age	Strand – Scientific Inquiry Substrand - 1.0 Observation and Investigation Foundation – 1.2, 48 and 60 months of age

Putting it together

The next step is a comparison of the students' completed grids. Encourage students to look for similarities and differences and to discuss why they did or did not link certain foundations to specific content standards when there are differences. If students worked individually on their grids, instructors may want them to first compare their grids with a few other students before doing a full class discussion.

If students worked in pairs or small groups, instructors may wish to start with a full class discussion. Depending on the size of the class, each pair or group could take a turn sharing the foundations they identified for each standard until all the standards have been compared. Again encourage discussion about any differences in the students' grids.

Taking it further

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Remind students that the preschool science foundations were also organized to align with the *National Science Education Content Standards* (National Committee on Science Education Standards and Assessment and National Research Council 1996). Review the standards with students, noting that these standards are designated for the grade level groupings K–4, 5–8, and 9–12.

There are eight categories of content standards in the *National Science Education Content Standards* (National Committee on Science Education Standards and Assessment and National Research Council 1996).

The standards for grade levels K–4 are summarized in the following outline:

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Unifying Concepts and Processes (Note that this standard is for grades K-12)
- Systems, order, and organization
- Evidence, models, and explanation
- Change, constancy, and measurement
- Evolution and equilibrium
- Form and function

Science as Inquiry Standards
- Abilities necessary to do scientific inquiry
- Understanding about scientific inquiry

Physical Science Standards
- Properties of objects and materials
- Position and motion of objects
- Light, heat, electricity, and magnetism

Life Science Standards
- Characteristics of organisms
- Life cycles of organisms
- Organisms and environments

Earth and Space Science Standards
- Properties of earth materials
- Objects in the sky
- Changes in earth and sky

Science and Technology Standards
- Abilities to distinguish between natural objects and objects made by humans
- Abilities of technological design
- Understandings about science and technology

Science in Personal and Social Perspectives
- Personal health
- Characteristics and changes in populations
- Types of resources
- Changes in environments
- Science and technology in local challenges

History and Nature of Science Standards
- Science as a human endeavor

Because the standards cover several grade levels, it is important for students to recognize how the standard applies to the youngest

or kindergarten-age children. Reading through the sections titled "Fundamental abilities and concepts that underlie this standard" for each standard may help students identify behaviors that would be typical of kindergartners.

After the review, instructors could ask the students to either (1) respond to questions or (2) complete a comparison grid.

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1. Students discuss or write responses to the following two questions:

   Question 1. What are some of the similarities and differences between these national standards and the California kindergarten science standards?

   The following points are examples of some of the similarities and differences and are provided here as a reference for instructors.

   • *The grade level designations are different. The California standards are separate for each grade whereas the national ones are for grade level groupings.*

   • *The number of categories is different; there are eight national standards and four California ones.*

   • *The titles for some of the standards are the same while others are different.*

   • *The national standards have a fair amount of detail in classroom vignettes and the fundamental concepts and principles underlying each standard that helps to explain the standards.*

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   Question 2. How has this review of the *National Science Education Content Standards* added to your understanding of the preschool science foundations, children's development of skills and knowledge in the science domain, and the role of

Online Options

If the class has online-discussion capability, students could review the *National Science Education Content Standards* individually and then the instructor could lead a discussion of the two questions.

science in the preschool curriculum?

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2. Students complete a grid comparing these national standards with the California preschool science foundations. Instructors may choose to give students Handout 2 or ask them to develop their own grids. Students could work individually or in pairs or small groups and then compare and discuss their completed grids.

Online Options

If the class has document-sharing capability, students could complete the comparison grids individually and then share them online. Instructors could review the grids and provide feedback or lead a discussion of the students' results.

Another approach/way

Instead of having students complete all sections of the grid comparing California's preschool science foundations and the kindergarten science content standards, instructors may choose to divide the class into small groups and assign each group a certain number of the kindergarten standards and subitems. Then after each group presents its findings, the rest of the class could ask questions and/or suggest additional foundations.

Reflection

This session can be concluded with a class discussion of the following questions:

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- What stood out for you from the comparison of the *Science Content Standards for California Public Schools, Kindergarten Through Grade Twelve* and the science foundations in the *California Preschool Learning Foundations, Volume 3*?
- What were some of the main similarities and differences between the standards and the foundations? What might be some reasons for these similarities and differences?
- Why do you think it's important for preschool teachers to be knowledgeable about the kindergarten science content standards?
- What are key ideas from this learning experience that you'll keep in mind in your work as a preschool teacher?

Deeper Understanding

All 50 states and the District of Columbia have developed early learning guidelines. These guidelines are defined by the Early Learning & Development Standards Web site (http://www.earlylearningguidelines-standards.org/content.php?s=what_are_elgs?) as "documents

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states have published to describe what children should know and be able to do before they start kindergarten. Some states call their documents 'early learning standards' or other titles such as 'foundations' or 'building blocks.'"

Depending on the number of students in the class, instructors may choose to ask students to each review the guidelines related to science from one or more states. They could then develop a resource sheet that might include the following information*:

- State and what the guidelines are called
- Year the guidelines were developed or adopted
- Ages of children addressed
- Purpose and intended use(s) of the guidelines
- Inclusion of guiding principles
- Domains and subjects included
- Summary of the guidelines for science
- Comparison with the preschool science foundations from the *California Preschool Learning Foundations, Volume 3*
- Information that helps you better understand the California preschool science foundations

Students can share the resource sheets with the other students, so that students will have a compilation of state early learning science guidelines as a reference.

*From *Early Learning Guidelines Resource: Recommendations and Issues for Consideration When Writing or Revising Early Learning Guidelines* (2010) by Catherine Scott-Little, Sharon Lynn Kagan, and Victoria Stebbins Frelow (downloaded on January 25, 2014, from http://www.earlylearningguidelines-standards.org/content.php?s=download_the_document).

Science Domain:
Learning Experience 5
Handout 1 – Linking Kindergarten Science Content Standards with Preschool Learning Foundations

Linking the *Science Content Standards for California Public Schools, Kindergarten Through Grade Twelve,* and the *California Preschool Learning Foundations, Volume 3*

Physical Sciences *1. Properties of materials can be observed, measured, and predicted. As a basis for understanding this concept:*		
a. Students know objects can be described in terms of the materials they are made of (e.g., clay, cloth, paper) and their physical properties (e.g., color, size, shape, weight, texture, flexibility, attraction to magnets, floating, sinking).	*b. Students know* water can be a liquid or a solid and can be made to change back and forth from one form to the other.	*c. Students know* water left in an open container evaporates (goes into the air) but water in a closed container does not.
Strand(s), substrand(s), & foundation(s):	Strand(s), substrand(s), & foundation(s):	Strand(s), substrand(s), & foundation(s):

Linking the *Science Content Standards for California Public Schools, Kindergarten Through Grade Twelve,* and the *California Preschool Learning Foundations, Volume 3*

Life Sciences *2. Different types of plants and animals inhabit the earth. As a basis for understanding this concept:*		
a. Students know how to observe and describe similarities and differences in the appearance and behavior of plants and animals (e.g., seed-bearing plants, birds, fish, insects).	*b. Students know* stories sometimes give plants and animals attributes they do not really have.	*c. Students know* how to identify major structures of common plants and animals (e.g., stems, leaves, roots, arms, wings, legs).
Strand(s), substrand(s), & foundation(s):	Strand(s), substrand(s), & foundation(s):	Strand(s), substrand(s), & foundation(s):

Linking the *Science Content Standards for California Public Schools, Kindergarten Through Grade Twelve,* and the *California Preschool Learning Foundations, Volume 3*

Earth Sciences *3.* Earth is composed of land, air, and water. As a basis for understanding this concept:		
a. Students know characteristics of mountains, rivers, oceans, valleys, deserts, and local landforms.	*b. Students know* changes in weather occur from day to day and across seasons, affecting Earth and its inhabitants.	*c. Students know* how to identify resources from Earth that are used in everyday life and understand that many resources can be conserved.
Strand(s), substrand(s), & foundation(s):	Strand(s), substrand(s), & foundation(s):	Strand(s), substrand(s), & foundation(s):

Linking the *Science Content Standards for California Public Schools, Kindergarten Through Grade Twelve,* and the *California Preschool Learning Foundations, Volume 3*

Investigation and Experimentation *4. Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept and addressing the content in the other three strands, students should develop their own questions and perform investigations. Students will:*				
a. Observe common objects by using the five senses.	*b.* Describe the properties of common objects	*c.* Describe the relative position of objects by using one reference (e.g., above or below).	*d.* Compare and sort common objects by one physical attribute (e.g., color, shape, texture, size, weight).	*e.* Communicate observations orally and through drawings.
Strand(s), substrand(s), & foundation(s):	Strand(s), substrand(s), & foundation(s):	Strand(s), substrand(s), & foundation(s):	Strand(s), substrand(s), & foundation(s):	Strand(s), substrand(s), & foundation(s):

Linking the *National Science Education Content Standards* and the *California Preschool Learning Foundations, Volume 3*

Instructions: After reviewing the eight standards from the *National Science Education Content Standards*, identify some foundations from the science domain that relate to each standard.

Unifying Concepts and Processes • Systems, order, and organization • Evidence, models, and explanation • Change, constancy, and measurement • Evolution and equilibrium • Form and function	Science as Inquiry Standards • Abilities necessary to do scientific inquiry • Understanding about scientific inquiry	Physical Science Standards • Properties of objects and materials • Position and motion of objects • Light, heat, electricity, and magnetism	Life Science Standards • Characteristics of organisms • Life cycles of organisms • Organisms and environments
Strand(s), substrand(s), & foundation(s):	Strand(s), substrand(s), & foundation(s):	Strand(s), substrand(s), & foundation(s):	Strand(s), substrand(s), & foundation(s):

Linking the *National Science Education Content Standards* and the *California Preschool Learning Foundations, Volume 3*

Earth and Space Science Standards • Properties of earth materials • Objects in the sky • Changes in earth and sky	Science and Technology Standards • Abilities to distinguish between natural objects and objects made by humans • Abilities of technological design • Understandings about science and technology	Science in Personal and Social Perspectives • Personal health • Characteristics and changes in populations • Types of resources • Changes in environments • Science and technology in local challenges	History and Nature of Science Standards • Science as a human endeavor
Strand(s), substrand(s), & foundation(s):	Strand(s), substrand(s), & foundation(s):	Strand(s), substrand(s), & foundation(s):	Strand(s), substrand(s), & foundation(s):