K-5 Science Curriculum Analysis Worksheet

Current research on science education emphasizes the importance of integrating the learning progressions from all three dimensions included in *A Framework for K-12 Science Education* in order to deepen student understanding of the big ideas connected to scientific phenomena. This Curriculum Analysis Worksheet is a tool that can be used to align your current instructional practices to a 3-dimensional model of instruction, designed to deepen student learning.

1.	Identify a science concept or concepts within the Arizona Science Standard from Strands 4, 5, or 6 that you teach at your grade level/course. Record the science concept, big idea/scientific phenomena, and the three-dimensional learning outcome(s).
2.	Identify learning progressions from each of the three dimensions that will be bundled together to build student conceptual understanding of the big idea/scientific phenomena selected in Step 1.
3.	a. Identify objectives from the Arizona Science Standard from Strands 1, 2 and 3 that align with the **Science and Engineering Practices** learning progression(s) you have identified in Step 2. b. Examine your current science curriculum to identify ways you can modify instruction to reach the vision of *A Framework for K-12 Science Education* while you currently teach grade level objectives aligned to the Arizona Science Standard.
4.	a. Identify the current objectives from the Arizona Science Standard from Strands 4, 5, and 6 that align with the **Disciplinary Core Ideas** learning progression(s) you have identified in Step 2. b. Examine your current science curriculum to identify ways you can modify instruction to reach the vision of *A Framework for K-12 Science Education* while you currently teach grade level objectives aligned to the Arizona Science Standard.
5.	a. Identify the current unifying concept(s) from page viii of the Arizona Science Standard that aligns with the **Crosscutting Concepts** learning progression(s) you have identified in Step 2. b. Examine your current science curriculum to identify ways you can modify instruction to reach the vision of *A Framework for K-12 Science Education* while you currently teach grade level objectives aligned to the Arizona Science Standard.
6.	a. Identify connections to grade level ELA/Literacy standards, as appropriate. b. Identify connections to grade level Mathematics standards and practices, as appropriate.

1. **Arizona Science Concept:** Strand 4 Concept 2: Life Cycles

Big Idea/Scientific Phenomenon: Genetic information is passed down from one generation of organisms to another.

- Living things produce offspring that are similar but not identical to each other or their parents.

2. Science and Engineering Practices Learning Progression *(See Learning Progressions for K-5 Science)*	**Disciplinary Core Ideas Learning Progression** *(See Learning Progressions for K-5 Science)*	**Crosscutting Concepts Learning Progression** *(See Learning Progressions for K-5 Science)*
Constructing Explanations and Designing Solutions Builds on prior experiences and progresses to the use of evidence and ideas in constructing evidence-based accounts of natural phenomena and designing solutions. ▯ Make observations (firsthand or from media) to construct an evidence-based account for natural phenomena.	**LS3: Heredity: Inheritance and Variation of Traits** Organisms have characteristics that can be similar or different. Young animals are very much, but not exactly, like their parents and also resemble other animals of the same kind. Plants also are very much, but not exactly, like their parents and resemble other plants of the same kind. ▯ Individuals of the same kind of plant or animal are recognizable as similar but can also vary in many ways.	**Patterns** Students recognize that patterns in the natural and human designed world can be observed, used to describe phenomena, and used as evidence.

Three Dimensional Learning Outcome(s):

- Construct an evidence based explanation that young plants and animals are alike, but not exactly like, their parents.

3. Science and Engineering Practices

Current Practice

Identify performance objectives from Strands 1-3 within the Arizona Science Standard that align to the learning progressions listed above.
(Strand 1: Inquiry; Strand 2: History and Nature of Science; Strand 3: Science and Social Perspectives)

S1C1: Observations, Questions, and Hypotheses

PO 1. Observe common objects using multiple senses.

PO 2. Ask questions based on experiences with objects, organisms, and events in the environment.

S1C3: Analysis and Conclusions

PO 1. Organize (e.g., compare, classify, and sequence) objects, organisms, and events according to various characteristics

S1C4: Communication

PO 1. Communicate observations with pictographs, pictures, models, and/or words.

PO 2. Communicate with other groups to describe the results of an investigation.

Vision of A Framework for K-12 Science Education

Gap Analysis/Curriculum Examination
Refer to the Science and Engineering practice learning progressions within the Learning Progressions for K-5 Science document and your current curriculum to answer the following questions.

- What practices are currently missing from my curriculum?
- What changes and refinements need to be made?
- What strategies/investigations can be implemented to achieve the vision?

Students construct an evidence-based explanation for natural phenomena.

- End goal: students make a claim about the patterns observed between parents and offspring (plants and animals) and support it with evidence and reasoning (C-E-R).
- Target claim: **"Young (plants and animals) look like, but not exactly like, their parents, and will grow to physically resemble their parents"**

Teacher needs to provide enough data/examples for evidence

- Provide books and/or pictures to match parents with offspring
- Use a wide variety of animals
- Start with obvious animal examples: mammal vs fish, lizard vs bird and then work to more specificity (lion vs house cat, Siamese cat vs Persian cat).
- Repeat using a wide variety of plants working to more specificity.
- Make sure examples are rich enough and diverse enough for students to make a claim based on the examples.
- Make sure examples are rich enough and diverse enough for students to cite evidence to support their claim from the examples.

Reasoning should include references to similar body structures between parents and offspring, but also include differences in size, coloration, or other variable features, such as differences between genders.

4. Disciplinary Core Ideas

Current Performance Objectives

S4C2: Life Cycles

PO 1. Describe that most plants and animals will grow to physically resemble their parents.

S4C3: Organisms and Environments

PO 1. Identify some plants and animals that exist in the local environment

S4C1: Characteristics of Organisms

PO 2. Name the following human body parts:

- head
- shoulders
- arms
- elbows
- wrists
- hands
- fingers
- legs
- hips
- knees
- ankles
- feet
- heels
- toes

Vision of *A Framework for K-12 Science Education*

Gap Analysis

Refer to the Content learning progressions within the Learning Progressions for K-5 Science document and your current curriculum to answer the following questions.

- What core idea(s) is/are currently targeted within my current curriculum?
- What changes and refinements need to be made? (add, refine, delete concepts)
- What strategies/investigations can be implemented to achieve the vision?

Depending on student knowledge and background, may need to spend time learning names of common plants and animals used in the picture activity.

Depending on student knowledge and background, may need to spend time learning names of common parts for humans, plants, and/or animals so students can make comparisons to use as their evidence and reasoning.

Examples:

- Kittens grow up to look like adult cats because they both have 4 legs, 2 ears, a tail, have fur, and big whiskers.
- A young pine tree will look like an adult pine tree. Even though it is smaller, they both have branches and rough bark, and many small leaves (needles).

Help students identify individual differences between parents and offspring.

- The adult male lion has a mane, but the female adult does not. They are still both lions. The young lion also does not have a mane, but it is still a lion.
- The adult pine tree has pine cones, but the young pine tree does not. They are both still pine trees.

Example of instructional strategies from 2061 Project of Using Phenomena to Promote Science Literacy

How Offspring Resemble Their Parents: Relevant Phenomena for K-2 Students

5. Crosscutting Concepts

Current Crosscutting Concepts

Unifying Concepts and Processes (Crosscutting concepts)
Listed in page viii of the front matter of the Arizona Science Standard, and explained in the National Science Education Standards (1995) pp. 115-119

Systems, Order, and Organization

Vision of *A Framework for K-12 Science Education*

Gap Analysis
Refer to the Crosscutting Concepts learning progressions within the Learning Progressions for K-5 Science document and your current curriculum to answer the following questions.

- How is/are the crosscutting concept(s) made explicit within my current curriculum?
- What changes and refinements need to be made?
- What strategies/investigations can be implemented to achieve the vision?

Patterns:
Students recognize that patterns in the natural and human designed world can be observed, used to describe phenomena, and used as evidence.

Help students recognize patterns in nature by comparing similarities between related organisms and differences between non-related organisms.

- Similarities between related organisms
  - Animals with wings have babies with wings.
  - Animals with a tail have babies with a tail.
  - Plants with thorns come from plants with thorns.
  - Plants that grow apples with produce new plants the grow apples.
- Differences between non-related organisms
  - Birds have wings but cats don't.
  - Lizards have tails but people don't.
- Compare patterns between similarities and differences in organisms
  - A baby bird should have wings but a baby cat does not have wings.
  - A baby lizard should have a tail but a baby person does not have a tail.

6. Connections

Other Content Area Standards

Identify other Content Area Standards that will build student understanding of this concept or phenomenon, especially those in ELA/Literacy and Mathematics/Practices.

K.RI.1. Ask and answer questions about key details in a text.

K.RI.3. With prompting and support, describe the connection between two individuals, events, ideas, or pieces of information in a text.

W.1.7. Participate in shared research and writing projects (e.g., explore a number of "how-to" books on a given topic and use them to write a sequence of instructions).

W.1.8. With guidance and support from adults, recall information from experiences or gather information from provided sources to answer a question.

K.SL.1. Participate in collaborative conversations with diverse partners about *kindergarten topics and texts* with peers and adults in small and larger groups.

a. Follow agreed-upon rules for discussions (e.g., listening to others, taking turns speaking about the topics and texts under discussion).
b. Continue a conversation through multiple exchanges.

K.SL.6. Speak audibly and express thoughts, feelings, and ideas clearly.

Connections to Instruction

Gap Analysis

Refer to the Other content standards that are being used as a connection to answer the following questions.

- How are the connected standards explicitly taught within my current curriculum?
- What changes and refinements need to be made?
- What strategies/investigations can be implemented to achieve the vision?

Reading:

- Provide trade books about animals and their babies. Class read-alouds asking key details about text and/or pictures in books to identify similarities between parent and offspring.
- Include books on lifecycles of plants (focus on physical features of adult plant vs young instead of the lifecycle).

Speaking and Listening:

- Small group or class discussion to answer question about whether young plants and animals look like their parents.
- Use books and pictures to find evidence and support explanation (C-E-R) that plants and animals grow to resemble their parents (inheritance of traits)

Writing:

- Write explanation (C-E-R) using words and/or pictures.