Lesson 1 Title: How do offspring (puppies) differ from their parents?

This Lesson: After a good amount of exposure to photos/media/fiction and non-fiction books of dogs and their puppies, students begin to predict traits of puppies based on common traits of the parents.

Time Frame: 2 science classes of 30 minutes (each)

Materials: Books, videos, etc. of dogs with puppies (found below in the Supporting Resources section).

Science Background: Animals and their offspring have traits that are easily identifiable. Offspring are alike in many ways and are different in distinct ways. Some traits will be observable in both the parent and offspring, some will not. The students will begin to develop recognition of common traits after they make lots of observations of puppies and their parents. These lessons help the young child begin to observe, generalize and predict after understanding this.

Vocabulary:

traits: Characteristics that make an organism special. The way that a living thing is structured, the way its body works and the way that it acts are all traits. These basic traits are shared by all the members of the group, that is why they are put in the same group. Other traits are only shared by a small number of the group.

What Students Figure Out: Individuals of the same kind of animal are recognizable as similar, but can differ in many ways. There are observable inheritable traits for dogs. Examples might be color of fur, length of fur, shape of ear, length of legs, shape of snout, size, etc.

Lesson Progression:
Days 1-2: days of exposing students to books and videos of puppies with their parents, engaging them in meaningful sharing of observable traits.

Supporting Resources:
-Literature Links (non-fiction and fiction)
Literature Links: Puppies

- video links of dogs with puppies (suggested that you play these with volume off): Proud Dogs Love Their Puppies Compilation

- videos of breed-specific puppies with parents and discussion of traits (all less than 8 minutes long from Animal Planet):
  Border Collie: https://www.youtube.com/watch?v=gY_KujhVW6s
  Beagles: https://www.youtube.com/watch?v=v0CBszd4fQI
  Corgi: https://www.youtube.com/watch?v=cS6J6BLDZoo
  St. Bernard: https://www.youtube.com/watch?v=eS8PUp1OZ6c
  Mixed Breed: https://www.youtube.com/watch?v=EYEc9kEVt_A
  Great Danes: https://www.youtube.com/watch?v=ct-L-dmEY

-Google Presentation: Puppies!
Puppies!

-Puppy Litter Cards:
Puppy Litters.pdf
Lesson 2 Title: How can traits be used to identify (by matching) puppies to their parent dogs?

This Lesson: Small (or whole) group activity using Observation Cards, then individual matching game assessment of teacher’s design

Time Frame: 1 class of 30 minutes

Materials:
- Observation Display (smartboard sharing where each page shows dogs with their litter of puppies)
- Matching game (dog parent pair matched to a possible puppy)

Science Background: We can identify common traits of puppies (shared by the entire litter like ear and snout shape, fur type, size of body and legs) and/or divergent traits (like the exact color of fur, specific markings/spotting of fur).

Vocabulary:

traits: (see Lesson 1)

divergent: tending to be different or develop in different directions.

What Students Figure Out: Individuals of the same kind of animal are recognizable as similar, but can differ in many ways. There are observable inheritable traits for dogs.

Lesson Progression:
- Small groups are given a set of 3 Puppy Observation Cards. Students are asked to identify common and divergent traits of the parent and/or puppies on each card. Re-group whole class, each card is shared on a smart-board and class lists their findings.
- Individual assessment follows with a Matching Game. Kids draw a line connecting the puppy to the parent dog.
Lesson 3 Title: Can you predict and build a model of a puppy that might be born in a litter of an identified pair of adult dogs?

This Lesson: The students individually construct a model of a predicted offspring of two dogs (male and female). All "puppies" are displayed as the offspring of the "parent dogs" on a classroom display.

Time Frame: 1 class of 30 minutes

Materials:
- Copies of body, leg, head and tail components for each table (from Build a Puppy)
- Classroom board displaying two adult dogs (sires of the puppy litter the kids are creating)

Science Background: We can identify common traits of puppies (shared by the entire litter like ear and snout shape, fur type, size of body and legs) and/or divergent traits (like the exact color of fur, specific markings/spotting of fur).

Vocabulary:
- traits: (see Lesson 1)
- divergent: (see Lesson 2)

What Students Figure Out: Individuals of the same kind of animal are recognizable as similar, but can differ in many ways. There are observable inheritable traits for dogs.

Lesson Progression:
Creating a model of a puppy that results from the mating of a specific pair of male and female dogs. Post the "parents" in the classroom. Follow the directions for the Build A Puppy activity (directions and reproducible body parts) found in the Supporting Resource Section). Post all model puppies around the parent dogs.

Supporting Resources:
Build A Puppy Activity: After a discussion of the parent dogs' traits, kids choose traits (body shape, head shape, leg shape, ear shape, tail shape) as they build a puppy for the class litter. The students color in, cut out, and glue their choice of traits for each of their own puppies. They name their puppy and add it to the class "litter" by displaying it near the parent dogs. Each child will need 1 copy of each page.
Lesson 4 Title: How do the traits of specific dog breeds help them solve problems and survive?

This Lesson: Students are encouraged to identify a trait (an attribute) of dogs or puppies and then try to explain why that trait helps the dog survive.

Time Frame: 1 class of 30 minutes

Materials: puppy/dog photos

Science Background: Biologists have realized that easily observable traits help animals survive. The dog has evolved to have many traits related to their ability to survive. An acute ability to hear, body size, snout shape, acute ability to smell, leg length, webbed paws are all examples of these adaptations. A specific example: dogs are at least 100,000 times more sensitive to smell than humans. They can detect odors at extremely low levels, and detect subtle differences in those odors. This has helped protect them and guide them to survive better in the natural world.

Vocabulary: traits (see previous Lessons)

What Students Figure Out?: We can determine patterns in dog traits (physical and behavioral) that help offspring survive.

Lesson Progression:
Gather kids and read a book that relates traits to survival of animals (need not be specifically dogs). Return to puppies and dogs. Display photographs. Each child takes a picture, circles the trait they can identify that helped that dog survive, and then share their findings with the class.

Supporting Resources:
Description of Physical Characteristics of Dogs
Free Use dog/puppy photos needed
Lesson 5 Title: Can we design then draw an/or construct a model of a dog trait that might help some humans?

This Lesson: Students are asked to determine a problem or an issue a human might have that might be solved by an engineered intervention that adapts a dog trait. The kids can either draw a model of the invention, or construct some sort of 3-D model (teacher’s choice). Then, the kids share their engineering/designing with the others in the class explaining what was the problem, how did they think about a solution for this problem, and exactly what is their invention.

Time Frame: 1 class of 30 minutes

Materials:
- Drawing paper or
- Gathered materials that could be reconfigured and used as materials for their invention

Science Background: Engineers are asked to solve problems by designing and constructing solutions. Our activity today asks the students to be creative and design and build a solution to a problem a dog may have. We are asking them to engineer a solution.

Vocabulary:
engineering: the art or science of solving a problem by constructing a solution using their imagination, with science and math as tools.

What Students Figure Out? Sometimes, a person is born with a disability or develops one as life goes on. This may interfere with their ability to survive. We can, as engineers do, design and build a model that could solve a problem a human may have thinking about traits of dogs and puppies. Some examples of this might be configuring a new ear shape aid for those hard of hearing, asking an unbalanced person to adapt a tail, providing a prosthetic set of legs for the unstable, etc..

Lesson Progression: As stated in the Storyline

Supporting Resources:
- Stem from the Start video of bioengineering a solution for a dog
  https://stemfromthestart.org/lesson/mission-awesome-animals