

***Does Your Dog Measure Up?
Understanding The Dogs We Love – A Mathematical Unit of Measure***

By: Maggie Mason, 2018 CTI Fellow
(Davidson Elementary School)

This curriculum unit is recommended for:
(1st - 3rd grade mathematics)

Keywords: measurement, math, estimate, compare, length, data, bar graph, unit of measure, dogs, and pets.

Teaching Standards: See [Appendix 1](#) for teaching standards addressed in this unit. (Insert a hyperlink to Appendix 1 where you've stated your unit's main standards. For directions on how to insert a hyperlink, see Fellows Handbook, p. 24.)

Synopsis: This curriculum unit focuses on students knowing how to accurately measure length (in inches) using several measuring tools. Students will estimate, measure, and analyze the major body parts of three different breeds of dogs. The goal is for students to participate in meaningful measurement activities to learn how the lengths of a dog's body parts impact the functionality and physical ability of its lifestyle needs and behaviors. Students will measure the body parts by using cardboard replicas of nine body parts each from a Bassett Hound, Pug, and Dalmatian. As the lessons and activities progress, students are expected to improve in the accuracy of their estimations and measuring skills. They will use their data to solve comparison math story problems, as well as addition and subtraction problems related to the measurement data collected during instructional activities. Students will then use their data to create visual representations in the form of bar graphs to critically analyze the information and draw conclusions about the physical actions and behaviors of each dog breed.

I plan to teach this unit during the coming year to 20 students in second grade.

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Introduction

Rationale

I chose to create this unit for two reasons. First, as educators it's important to teach children how to actively engage in learning while making connections to their own life and surrounding world. Offering students opportunities to explore their *passions* and *strengths* to gain knowledge and teach others fosters a love of learning, improves academic achievement, and enhances social interactions.

Over the course of my teaching career I've observed how pets are a large part of a child's home life, how children can't wait to share experiences about going to a farm or zoo when they enter the classroom on Monday morning, or how they quickly select an animal book from a hundred other options in the class library to read.

Students are more motivated to learn new content if it's related to something that matters to them, or if it has significance and a connection to their own life. When they have some background knowledge and care, they feel comfortable discussing and asking questions with peers. They go deeper into the learning process and stay engaged because it relates to their own life.

My second reason for writing this unit is based on content understanding. I've taught 3rd grade for the last three years. At the end of the school year I review a variety of student assessment scores in mathematics. The content area involving measurement and data is always the lowest. I have tried different teaching strategies and activities to improve student understanding, but achievement is not where I would like it to be. By connecting this topic area to something many children enjoy and resonate with, I am hoping to improve understanding so students will have the solid foundation they need prior to entering upper elementary grades.

I am interested to see if using an entire unit focused on "dogs as pets" will improve students' academic achievement of the Common Core Measurement Standards in mathematics. In second grade, students learn about how to measure the length of objects by selecting appropriate tools and using different units of measure. They have to estimate and compare lengths, as well as solve math word problems involving lengths in the same units. Typically this is taught by measuring small classroom objects or pictures on workbook pages. I've also had students measure the distance of his or her standing long jump or how far they can slide an object across the floor. While some of these activities engage the student for a specific time period, their commitment to stay involved in the learning process dwindles once we resort back to traditional methods.

My goal is to use my unit with a traditional classroom of 19 second-grade students at Davidson Elementary. The school is located in the suburbs of the Charlotte Mecklenburg School District about 25 miles north of the city of Charlotte. My classroom consists of 11 girls and 8 boys. Two students are African American and 17 are White. All students speak English as their main language and receive all educational instruction within the general classroom setting. Students at our school are not formally tested in math at the end of second grade. Therefore, I will analyze MAP (Measures of Academic Progress) data as one resource to monitor student

understanding. I will also use classroom activities, short informal checkpoints, and standards-based assessments compiled in a portfolio to be sure students have an understanding of the measurement concepts. It is important students can explain and demonstrate the skills by the end of the year prior to going to third grade. Gaps in student understanding will create more challenges for the student in meeting grade-level expectations.

Content Research

A great deal of research supports my observations from teaching in the K-3 classroom for the last twelve years. This being that most children are interested in learning about, or interacting with, pets and other domestic animals. Think about it...both fictional storybooks and non-fiction informational texts about animals can be found in most households with children in the country. The success of movies such as, "The Secret Lives of Pets", "Cats and Dogs" and "A Dog's Purpose" show how not only children, but adults, enjoy watching movies about pets and families. This is not a new phenomenon either. Classics such as Benji (1974), Old Yeller (1957), and Lassie Come Home (1943) suggest that this has been a common interest for years. If you bring a puppy or kitten in the proximity of a child they are immediately drawn to the furry creature!

Children want to be around animals for companionship. When my son was 5-years old, he kept asking us to get him a pet. He didn't care what it was at the time. He just wanted something in his room to keep him company, especially at night. By the time he was 8-years old, we had moved from frogs to rabbits to finally getting his most beloved pet ever - a Golden Retriever puppy! Little did I know, over the next 9 years, how much this puppy would become such a strong companion for my only son.

Dogs as Companions

We've all heard the phrase, "A dog is a man's best friend". Well, there is significant research suggesting this bond is not just with men. Some children form stronger bonds with their dogs than with other human family members. In 2017, a study was done by a Cambridge University researcher who analyzed the interactions of 12 year-olds and their pets in 77 homes in Britain. The children were asked to describe their relationship with all their family members, both 2-legged and 4-legged.¹ Four factors were considered in the study; (a) Satisfaction with the relationship, (b) Feeling of companionship, (c) Communication, and (d) Comfort.²

The results of the study indicated these children felt a stronger bond and had more satisfaction in their relationship with their canine family member compared to the rest of the family.³ The children in the study reported to have less conflict with their pet than with their siblings. They also shared how they expressed their thoughts and feelings to their pets just as much as they did to their siblings, but without having to hear negative feedback.⁴

Researcher, Matt Cassell, explains how the interactions between animals and children can be powerful. Dogs and cats make eye contact, show facial expressions, and appear to show empathy.⁵ A pet doesn't respond, judge, or say anything. Therefore, children may feel safer

expressing themselves to a pet. The research adds to increasing evidence that household pets may have a positive impact on a child's social skills and emotional health.⁶

Kids naturally like to be near animals, and they like the comfort of their pets when they feel upset or unhappy. Parents of children with pets have shared on how their children seem less anxious and withdrawn compared to those having children without pets.⁷ Animals are also instant playmates. They are true family members and involved in family activities like walks, outdoor vacations, playing ball, and so forth.⁸

Children also learn nurturing and empathy by taking care of animals. In a study conducted over a 24-hour period, researchers observed pet owning children to spend an average of 10.3 minutes caring for their pet. Those children without pets, and with a younger sibling to care for, spent only 2.4 minutes caring for their brother or sister.⁹

In addition, Dr. Gail Melson, a professor in the Department of Human Development and Family Studies at Perdue University has stated *biophilia* as a possible cause as to why children bond with pets, especially dogs.¹⁰ Biophilia suggests that human beings have an innate tendency to seek connections with nature and other forms of life.¹¹ A study of babies less than a year old showed they gave more attention and interest to the family dog than to a wind-up toy. As time went by, the relationship strengthened because of the emotional connection and mental capabilities of the dog. Dogs display more responsive interactions than a toy, which maintains the engagement of a young child.¹² Research also shows that infants pay more attention to films about living animals than they do to films with unreal objects.¹³

Since many dogs have the mental capabilities of a 2 or 3 year old, they therefore also have some developmental paths similar to children.¹⁴ Consider how young family members in the same house are trained or educated on how to interact with other human beings and objects.¹⁵ This is similar to, and reminds me of, the story, *Jungle Book*. In the story, a baby boy is found in the wild and raised by wolves. The wolves teach the boy how to live, interact, and understand the wild world around him in the jungle. This is parallel to a dog being brought into a family household and trained to exist in their world. Dogs are brought into a family as a wanted companion, which supports why some 60 million US households own dogs.¹⁶

For many people, dogs are seen as an additional family member. The difference is a dog does not criticize or show negative emotions. In one study, children were asked to read in front of a peer, an adult, and a dog. The kids were more relaxed and willing to snuggle up and read with a dog than a human being.¹⁷ On the flip side, recent studies of dogs' brains suggest they also have an extraordinary love for humans.¹⁸ A 2015 neuroimaging study about odor processing in a dog's brain found that when dogs smelled their owners, the "reward center" of their brains (called the caudate nucleus) lit up. The study also revealed that the dogs prioritized the smell of humans over all other smells.¹⁹

There is growing evidence that children turn to their pets for comfort, reassurance and emotional support when feeling anger, sadness, or happiness. It is possible that children with a companion animal, such as a dog or cat, may have the potential for better emotional health and reduced anxiety and depression.²⁰

In my research, I came across statistics about just how much human beings value their dogs and cats. Two thirds of Americans live with an animal, and according to a 2011 Harris poll, 90 percent of pet owners think of their dogs and cats as members of the family.²¹ In a survey by the American Animal Hospital Association, 40 percent of married female dog owners reported they received more emotional support from their pet than from their husband or their children.²² The pet industry and veterinary field have observed a growth in how people perceive their animal family members calling it, “humanization of pets”²³ People spend thousands of dollars on medical treatments, grooming, toys, and other products and services for their pets to be sure they are treated just as well as the people in the household.²⁴ With dogs and cats being considered true family members, there has been a shift in how these companions live day to day. Pets are sleeping in bed with their owners, getting presents on holidays and birthdays, receiving special meals and treats on certain occasions, attending spa and grooming days, and wearing costumes or clothing.²⁵

We have seen the traditional family unit change over the last decade. But now pets, such as dogs and cats, seem to be altering the definition of the family unit once again. Anthrozoologists, who study the relationships between humans and other animals, suggest several reasons why humans are so attached to their pets. First, pets help children learn how to be kind and responsible.²⁶ Second, pets can provide stability and help people feel more positive about their daily lives and experiences.²⁷ Third, dogs and cats can be great replacements for a human friend. Last, both pets and people enjoy the relationship because they feel loved and secure.²⁸

Dogs, in particular, can have an incredible impact on young children and adults. Research suggests children with dogs display improved impulse control, social skills and self-esteem.²⁹ Sharing the love and care of a family pet can also build a common bond within the family unit. Personally speaking, I know cuddling and playing with our dog brings our family together in the evenings, and helps us all de-stress and relax at the end of the day.

Canine Physical Dimensions and Behavior

The strong emotional bond many humans have with dogs greatly inspired my research for this unit. However, another relevant point sure to inspire interest with second graders is that dogs are descendants of wolves. Although many different breeds of dogs exist today that look far different than a wolf, this change in appearance has significantly altered the behavior and health of many dogs. Wolves are considered “well constructed” wild canines, with no disproportional body parts causing unnecessary health or mobility problems.³⁰ Many modern dogs today have this same body shape, where the proportions of the leg length and the length of the spine (between the hips and shoulders) are adequate for long-term health.³¹ These dogs also have a long muzzle for proper breathing, a longer tail for balance, and upright ears to prevent ear infections.³²

Conversely, many present day dogs have been bred in such a way that compromises the healthy proportions and functioning of their body parts. In turn, these disparities affect the overall demeanor and health of the dog.³³ Just the shape and length of a dog’s head alone can change its well-being and behavior. Two major dog face shapes have been studied in depth, and the effect these different constructs have on a dog’s quality of life. The first is dolichocephalic – a long face, and the second is brachycephalic – a short face.³⁴

In a study involving 67,368 dogs from 45 different breeds, data was collected over a period of eight years at 235 testing areas in Sweden. The behavior testing was done using the Dog Mentality Assessment Test, which is a standardized behavioral test involving 10 different subtests designed to measure a dog's aggressiveness, defensiveness, playfulness and sociability, fearfulness, chase instinct, curiosity.³⁵

The brachycephalic dogs, like Pugs and Bulldogs, were more engaged with their owners in direct play, but were easily startled by strange people or objects.³⁶ These dog breeds also suffer more from respiratory issues (and are less active) due to short snouts interfering with proper breathing. However, other short face dogs such as Mastiffs are very different than the brachycephalic Pug in that they are much larger in size. Mastiffs are more than twice as many inches tall at the shoulder than Pugs.³⁷ Mastiffs are also more expensive to care for, and not as compatible with other dogs.³⁸ The point is, if you want a compatible family member in your canine friend, it's important to research the size, weight, and typical behavior traits to be sure the dog is a good fit for you and your lifestyle.

In the Sweden study, the dolichocephalic dogs - think German Shepard or Bassett Hound - were less likely to engage in high-interest object play, especially with unfamiliar humans. However these long-faced dogs were not as easily startled and recovered more quickly when an unexpected event occurred.³⁹ Yet, let it be clear that these two dogs are very different despite their dolichocephalic similarity. A Bassett Hound has short legs and a long back, making it less able to run with a full gait at great speed. While a German Shepard is well proportioned and has a longer stride making it capable of running up to 30 miles per hour.⁴⁰ A German Shepard is also easier to train than a Bassett Hound.⁴¹ Again, knowing the facts about a dog's temperament and physical capabilities is important before bringing one home as part of the family. Doing your homework will ensure you provide a healthy environment to meet the needs of your dog and your family.

Other physical characteristics the researchers in Sweden were interested in were primarily the height and weight of the dogs, and the length of various body parts. For example, Dachshunds have short legs relative to the length of their spines. Such disproportions cause this breed to be slower runners and have back problems, especially slipped or ruptured disks.⁴² The Pug has a short screw tail. This type of tail can cause a Pug to have more infections or spine problems compared to dogs with longer, free flowing tails.⁴³ Other dogs, such as Greyhounds and Dalmatians, have long legs and deep ribcages for fast, powerful running.

I have only included a summary of some of the findings comparing the size measurements and behaviors of different breeds of dogs in this content research section of my unit. However, understanding how the physical dimensions of our canine family members correlate with their behavior and abilities is extremely relevant. If dogs are considered an extension of the family unit in a household, then we need to know how their physical traits impact not only their lives, but our relationship with them as well. During the implementation of the unit, students will begin to understand this importance as they compare and contrast different breeds of dogs by measuring their different body parts. Some replicas of the dogs will be made out of cardboard for students to measure with rulers and yardsticks. They will also measure and create body parts

(including dogs' heads, legs, tails, backs, torsos, etc.) using cardboard. They will compare the different body parts from different breeds. I feel their natural love and companionship with dogs, coupled with the variety of physical features innately interesting about dogs, will inspire engagement in learning the math standards involving measurement in second grade.

Instructional Implementation

Student Prior Knowledge (Time needed 2-3 days prior to Lesson #1).

Second Grade Math Curriculum Alignment

NC.2.MD.1 Measure the length of an object in standard units by selecting and using appropriate tools such as rulers, yardsticks, meter sticks, and measuring tapes

NC.2.NBT.5 Demonstrate fluency with addition and subtraction, within 100, by:

- Flexibly using strategies based on place value, properties of operations, and/or the relationship between addition and subtraction.
- Comparing addition and subtraction strategies, and explaining why they work.
- Selecting an appropriate strategy in order to efficiently compute sums and differences

Students will understand the different units of measure (inches, centimeters, feet, and yards) and how the units compare in size. For example, students will understand that centimeters are smaller units than inches, inches are smaller than feet, and feet are smaller than yards. Students will have practiced using different measurement tools (ruler, yardstick, measuring tape) to measure the lengths of objects in the classroom (at this point they do not need to know measurement conversions). Students will know how to use measurement tools accurately.

Students will understand the difference between length and width. They will use the word *length* to describe the longest sides of an object. They will use the word *width* to describe how wide the object is from one side to another.

Lessons 1 - 6

Second Grade Math Curriculum Alignment

- NC.2.MD.1 Measure the length of an object in standard units by selecting and using appropriate tools such as rulers, yardsticks, meter sticks, and measuring tapes
- NC.2.MD.2 Measure the length of an object twice, using length units of different lengths for the two measurements; Describe how the two measurements relate to the size of the unit chosen.
- NC.2.MD.3 Estimate lengths in using standard units of inches, feet, yards, centimeters, and meters.
- NC.2.MD.4 Measure to determine how much longer one object is than another, expressing the length difference in terms of a standard length unit.
- NC.2.MD.5 Use addition and subtraction, within 100, to solve word problems involving lengths that are given in the same units, using equations with a symbol for the unknown number to represent the problem.

- NC.2.MD.6 Represent whole numbers as lengths on a number line diagram with equally spaced points to find whole number sums and differences.
- NC.2.MD.10 Organize, represent, and interpret data with up to four categories. Draw a picture graph and a bar graph with a single-unit scale to represent a data set. Solve simple put-together, take-apart, and compare problems using information presented in a picture and a bar graph.

Lesson 1 Objectives:

Students will discuss and analyze the different physical characteristics of three dogs (a Bassett Hound, a Dalmatian, and a Pug) by looking at labeled pictures of each breed. Students will also measure the length of each body part of an adult male Bassett Hound using 2 dimensional models made of cardstock or cardboard.

Materials Needed and Teacher Preparation:

- Measuring tools (rulers, yardsticks, and measuring tape).
- Sets of each of the nine “true-to size” body parts of the Bassett Hound (one set for each group of students). Each set should include (1) nose + muzzle (from tear duct to tip of nose), (2) face (lower jaw to insertion of ear), (3) ear, (4) torso, (5) upper leg (from top of thigh to knee), lower leg (from knee to foot), (7) neck, (8) tail, and (9) foot.
- Student math journals and pre-made journal recording sheets to glue in each journal (one per student).
- A wall chart to record student measurements (3 rows with 9 columns).
- Five sets of pictures of each dog (with labeled body parts): A Bassett Hound, A Dalmatian, and a Pug.

Lesson 1

(1). The teacher will organize students into groups with four students in each group. Each group will receive three dog photos: A Bassett Hound, a Dalmatian, and a Pug

Students will work in small groups and analyze the pictures of each dog and the labeled parts. They will verbally describe the length of the labeled body parts using phrases such as, “The tail is shorter than the legs,” or “The neck is longer than the ears”.

The teacher will walk around the room and facilitate conversations.

Students will talk for 5 minutes and then write notes in their math journals about their observations for each dog. Each group will share one observation with the class.

(2). The teacher will review the names of the body parts of the dog using a large cutout labeled version of a dog model, or a projected photo on a SMART Board, to review these parts:

Nose + muzzle (from tear duct to tip of nose), face (lower jaw to insertion of ear), ear, torso, upper leg, lower leg, neck, tail, and foot.

(3). The teacher will give each group a recording sheet for the body measurements of an adult male Bassett Hound, a real-life replica of each body part made of cardstock (nine body parts in all), and a variety of measurement tools (rulers, yardsticks, and measuring tape). The students will measure (in inches) the length of each body part and record the measurement on their recording sheet. Each body part should be measured twice and both measurements should be recorded as “Measurement #1” and “Measurement #2”. This can be done with a student measuring the first time, and another student measuring the second time to confirm accuracy. Each body part will already be cut out to the exact inch, but students should remember to measure to the closest whole inch. Students should be reminded to measure from the longest tip of the length of the body part to the longest opposite tip.

Typical Adult Male Bassett Hound Length Measurements in Inches:

Nose + Muzzle	5
Face	5
Ear	9
Torso	17
Neck	8
Upper Leg	4
Lower Leg	3
Tail	12
Foot	2

After students finish recording, they will analyze their data and re-measure any body parts that do not have the exact same measurements. They will change any measurements they feel are incorrect on their recording sheet.

(4). The teacher will reveal the true measurements of each body part and put this data on the class chart labeled “Dog Body Part Lengths” under the heading “Bassett Hound” The class will review their findings and be sure all groups have the same measurements for each body part.

(5) Exit Ticket: Students will be asked to explain why it is important to measure objects two or more times. They will record their statements in their math journal. A class discussion will occur to share responses.

Lesson 2 Objectives:

Students will discuss and analyze the different physical characteristics of three dogs (a Bassett Hound, a Dalmatian, and a Pug) by looking at labeled pictures of each breed. Students will also measure the length of each body part of an adult Dalmatian using 2 dimensional models made of cardstock or cardboard.

Materials Needed and Teacher Preparation:

- Measuring tools (rulers, yardsticks, and measuring tape).
- Sets of each of the nine “true-to size” body parts of the Dalmatian (one set for each group of students). Each set should include (1) nose + muzzle (from tear duct to tip of nose), (2) face (lower jaw to insertion of ear), (3) ear, (4) torso, (5) upper leg (from top of thigh to knee), (6) lower leg (from knee to foot), (7) neck, (8) tail, and (9) foot.
- Student math journals and pre-made journal recording sheets to glue in each journal (one per student).
- A wall chart to record student measurements (3 rows with 9 columns).
- Five sets of pictures of each dog (with labeled body parts): A Bassett Hound, A Dalmatian, and a Pug.

Lesson 2

(1). The teacher will organize students into groups with four students in each group. Each group will receive three dog photos: A Bassett Hound, A Dalmatian and a Pug. Students will work in small groups and analyze the pictures of each dog and the labeled parts. They will verbally describe the length of the labeled body parts using phrases such as, “The tail is shorter than the legs.” “The neck is longer than the ears”.

The teacher will walk around the room and facilitate conversations.

(2). The teacher will review the names of the body parts of the dog using a large cutout labeled version of a dog model, or a projected photo on a SMART Board, to review these parts. Nose + muzzle (from tear duct to tip of nose), face (lower jaw to insertion of ear), ear, torso, upper leg, lower leg, neck, tail, and foot.

(3). The teacher will give each group a recording sheet for the body measurements of an adult male Dalmatian, a real-life replica of each body part made of cardstock (nine body parts in all), and a variety of measurement tools (rulers, yardsticks, and measuring tape). Students will first estimate the length in inches of each body part. They will record this as “Estimate” on their chart for each particular body part. The students will then measure (in inches) the length of each body part and record the measurement on their recording sheet. Each body part should be measured twice and both measurements should be recorded as

“Measurement #1” and “Measurement #2.” This can be done with a student measuring the first time, and another student measuring the second time to confirm accuracy. Each body part will be cut out to the exact inch, but students should remember to measure to the closest whole inch.

Typical Adult Male Dalmatian Length Measurements in Inches

Nose + Muzzle	6
Face	5
Ear	6
Torso	20
Neck	6
Upper Leg	7
Lower Leg	5
Tail	11
Foot	3

After students finish recording, they will analyze their data and re-measure any body parts that do not have the exact same measurements. They will change any measurements they feel are incorrect.

(4). The teacher will reveal the true measurements of each body part and put this data on the class chart labeled “Dog Body Part Lengths” under the heading “Dalmatian” The class will review their findings and be sure all groups have the same measurements for each body part.

(5). Exit Ticket: Students will be asked to write how accurate their estimations were to the actual lengths of the Dalmatian’s body parts. They will be asked to write a response to the question, “What is the purpose of estimation?” The teacher will conduct a class discussion to share student comments.

Lesson 3 Objectives:

Students will discuss and analyze the different physical characteristics of three dogs (a Bassett Hound, a Dalmatian, and a Pug) by looking at labeled pictures of each breed. Students will also measure the length of each body part of an adult male Pug using 2 dimensional models made of cardstock or cardboard.

Materials Needed and Teacher Preparation:

- Measuring tools (rulers, yardsticks, and measuring tape).
- Sets of each of the nine “true-to size” body parts of the Dalmatian (one set for each group of students). Each set should include (1) nose + muzzle (from tear duct to tip of nose), (2) face (lower jaw to insertion of ear), (3) ear, (4) torso, (5) upper leg (from top of thigh to knee), (6) lower leg (from knee to foot), (7) neck, (8) tail, and (9) foot.
- Student math journals and pre-made journal recording sheets to glue in each journal (one per student).
- A wall chart to record student measurements (3 rows with 9 columns).
- Five sets of pictures of each dog (with labeled body parts): A Bassett Hound, a Dalmatian, and a Pug.

Lesson 3

(1). The teacher will organize students into groups with 4 students in each group. Each group will receive three dog photos: A Bassett Hound, a Dalmatian and a Pug.

Students will work in small groups and analyze the pictures of each dog and the labeled parts. They will verbally describe the length of the labeled body parts using phrases such as, “The tail is shorter than the legs.” “The neck is longer than the ears”.

The teacher will walk around the room and facilitate conversations.

(2). The teacher will review the names of the body parts of the dog using a large cutout labeled version of a dog model, or a projected photo on a SMART Board, to review these parts.

Nose + muzzle (from tear duct to tip of nose), face (lower jaw to insertion of ear), ear, torso, upper leg, lower leg, neck, tail, and foot.

(3). The teacher will give each group a recording sheet for the body measurements of an adult male Pug, a real-life replica of each body part made of cardstock (nine body parts in all), and a variety of measurement tools (rulers, yardsticks, and measuring tape).

(4). Students will first estimate the length in inches of each body part. They will record this as “Estimate” on their chart for each particular body part. The students will then measure (in inches) the length of each body part and record the measurement on their recording sheet. Each body part should be measured twice and both measurements should be recorded as

“Measurement #1” and “Measurement #2”. This can be done with a student measuring the first time, and another student measuring the second time to confirm accuracy. Each body part will be cut out to the exact inch, but students should remember to measure to the closest whole inch.

Typical Adult Male Pug Length Measurements in Inches

Nose + Muzzle	2
Face	5
Ear	4
Torso	15
Neck	6
Upper Leg	6
Lower Leg	4
Tail	5
Foot	3

After students finish recording, they will analyze their data and re-measure any body parts that do not have the exact same measurements. They will change any measurements they feel are incorrect.

(4). The teacher will reveal the true measurements of each body part and put this data on the class chart labeled “Dog Body Part Lengths” under the heading “Pug” The class will review their findings and be sure all groups have the same measurements for each body part.

(5). Exit Ticket: Students will be asked to write a response in their math journal to the question, “Do you feel you are becoming more accurate with your measurements and estimations by using measuring tools on a regular basis? Why or why not?”

Lesson 4 Objectives:

Students will solve word problems related to the measurement data posted on the wall chart for the Bassett Hound, Dalmatian, and Pug.

Materials Needed and Teacher Preparation:

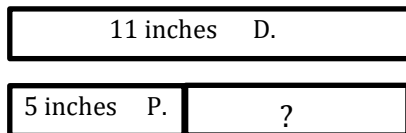
- Measuring tools (rulers, yardsticks, and measuring tape).
- Math tools: Hundreds Counting Chart, dry erase boards, markers, Base 10 blocks, anchor charts with math strategies for addition and subtraction to 100.
- Student math journals and pre-made word problems to glue in each student’s math journal (one per student).
- The wall chart with recorded dog length measurements from Lessons 1-3 (3 rows with 9 columns).

Lesson 4

(1) The teacher will ask students to get out their recording sheets for each dog. The teacher will explain how students will compare body measurements of the three dogs. The teacher will explain that when you “compare” two measurements you determine how much longer or shorter one measurement is from another measurement. For example, if a book is 12 inches long and a notepad is 10 inches long, then the book is 2 inches *longer* than the notepad, or you could say the notepad is 2 inches *shorter* than the book.

(2) The teacher will show a sample math problem of how to compare the lengths of two body parts from different animals.

EXAMPLE: Which is longer, the tail of a Pug or the tail of a Dalmatian? The tail of a Pug is 5 inches long and the tail of a Dalmatian is 11 inches long. Using a Bar Model, the teacher will show students the comparison in inches.



How much longer is the Dalmatian’s tail than the Pug’s tail?



$5 + \underline{\quad} = 11$ Add-on to 5 to get to 11. “5...6, 7, 8, 9, 10, 11”

$5 + \underline{6} = 11$

$11 - 5 = 6$... or subtract 5 from 11 to get 6.

(3) The teacher will give students a word comparison problem to glue in their math journal and to solve with a partner. Students will write an equation to represent the problem. Students will use an addition or subtraction strategy to solve the equation.

How much longer is a Bassett Hound's ear compared to a Pug's ear?

(4) The ear of a Pug is 4 inches long and the ear of a Bassett Hound is 9 inches long. Using a Bar Model, the teacher will show the comparison in inches.

The teacher will review how to solve the problem using addition or subtraction.

9 inches B.

4 inches P. ?

$$4 + \underline{\quad} = 9$$

Add-on to 4 to get to 9. "4...5, 6, 7,

8, 9"



$$4 + \underline{5} = 9$$

$$9 - 4 = 5 \quad \dots \text{ or subtract 4 from 9 to get 5.}$$

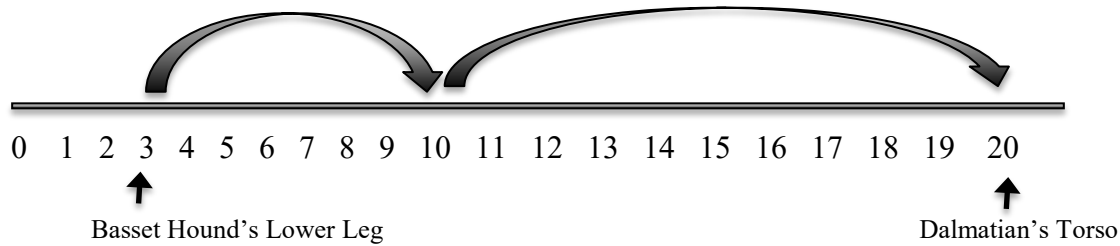
(5) The teacher will ask if there are any questions and check for misconceptions. Students will then choose 4 more word problems to glue in their math journal to solve using the data from the measurements obtained in Lessons 1-3.

Lesson 5

(1) The teacher will explain how addition and subtraction strategies used on an open number line can be applied to comparing measurement data. The teacher will explain how a number line is similar to a ruler, with equally spaced units to count, add, or subtract.

(2) The teacher will draw an open number line on the board or chart paper. The teacher will use data from Lessons 1-3 to show how to use the number line to solve math problems involving measurement units.

How much longer is a Dalmatian's torso than a Bassett Hound's lower leg?



The teacher will say, "From 3 to 10 on the number line is 7 inches. From 10 to 20 on the number line is 10 inches". If I add $7 + 10$, I will have 17. The Dalmatian's torso is 17 inches longer than a Bassett Hound's lower leg.

(3) Students will solve measurement problems involving addition and subtraction using an open number line. Data from Lessons 1-3 will be used in the story problems. Students will cut, paste, and solve the problems in their math journal.

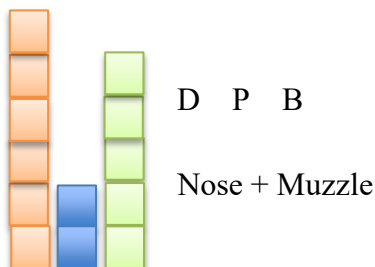
Lesson 6

(1) Students will create a bar graph to depict the data from Lessons 1-3. The teacher will explain how number data can more easily be analyzed with a visual bar graph to show comparisons.

(2) The teacher will model how to graph each body part for each breed of dog in Lessons 1-3. This will be done on chart paper, with a smaller version given to students to complete after the lesson.

(3) Using graph paper, the teacher will model how each square represents 1 inch. To represent the measurements of each breed of dog's nose + muzzle, the teacher will label and shade in the appropriate squares with different colors on the graph paper.

D = Dalmatian P = Pug B = Bassett Hound



(4) After students graph the lengths of the nine body parts of each dog, they will write three observations they observed about the data. Students will use specific number measurements and comparisons in their writing. For example; *each breed of dog has a face length of 5 inches, but the length of their ears are all different. The Bassett Hound's ears are 3 inches longer than a Dalmatian's ears and 5 inches longer than a Pug's ears.* Students will verbally share one of their written observations with the class.

(5) The teacher will facilitate a discussion about how a dog's measurements help people understand how varying breeds of dogs function differently in society. The form and function of a dog are important to a buyer depending on the purpose of obtaining the dog. For example, a Dalmatian is a better breed for runners due to the length of its legs in comparison to its torso. Pugs are a short-nosed breed, making it difficult for these dogs to cool themselves in warmer weather. A Bassett Hound has short legs and would not make a good running companion.

Assessment

Assessment of student understanding will take place informally throughout the unit. The teacher will observe, make anecdotal notes, and review student work during the lessons to determine if additional support and interventions are needed.

Appendix 1: Teaching Standards

The standards in the unit are from the North Carolina Department of Instruction. They are from the new course of study effective in all North Carolina schools starting in the 2018-19 school year.

Second Grade Math Curriculum Alignment

NC.2.MD.1 Measure the length of an object in standard units by selecting and using appropriate tools such as rulers, yardsticks, meter sticks, and measuring tapes.

Students will have the opportunity to use different measuring tools to measure the length of the each dog's modeled body parts. They will determine which tools are easier to use, and how these tools represent the same units of measure.

NC.2.MD.2 Measure the length of an object twice, using length units of different lengths for the two measurements; Describe how the two measurements relate to the size of the unit chosen. Students will learn the importance of precision in measurement and will be asked to measure the same body parts twice to ensure accurate information.

NC.2.MD.3 Estimate lengths in using standard units of inches, feet, yards, centimeters, and meters. Students will estimate the lengths of each dog's body parts to determine the reasonableness of their answers and to self-assess their ability to understand the approximate size of a unit of measure.

NC.2.MD.4 Measure to determine how much longer one object is than another, expressing the length difference in terms of a standard length unit. Students will answer a variety of comparison questions in which they will mathematically compare the body measurements of three different breeds of dogs.

NC.2.MD.5 Use addition and subtraction, within 100, to solve word problems involving lengths that are given in the same units, using equations with a symbol for the unknown number to represent the problem. Students will answer a variety of math story problems in which they will mathematically add or subtract the body measurements from three different breeds of dogs.

NC.2.MD.6 Represent whole numbers as lengths on a number line diagram with equally spaced points to find whole number sums and differences. Students will use an open number line to help solve addition, subtraction, and comparison problems involving units of measure. They will recognize the relationship between the units on a number line and the units on a measuring tool.

NC.2.MD.10 Organize, represent, and interpret data. Solve simple put-together, take-apart, and compare problems using information presented in a bar graph. Students will create a bar graph based on the measurement data they collect. They will analyze the data to make conclusions about the functionality and physical abilities of three breeds of dogs.

Appendix 2: Student Recording Sheet

Typical Adult Male Bassett Hound Length Measurements in Inches

Body Part Measurement 1 Measurement 2

Nose + Muzzle		
Face		
Ear		
Torso		
Neck		
Upper Leg		
Lower Leg		
Tail		
Foot		

Appendix 3: Student Recording Sheet

Typical Adult Male Dalmatian Length Measurements in Inches

Body Part Estimation Measurement 1 Measurement 2

Nose + Muzzle			
Face			
Ear			
Torso			
Neck			
Upper Leg			
Lower Leg			
Tail			
Foot			

Appendix 3: Student Recording Sheet

Typical Adult Male Pug Length Measurements in Inches

Body Part Estimation Measurement 1 Measurement 2

Nose + Muzzle			
Face			
Ear			
Torso			
Neck			
Upper Leg			
Lower Leg			
Tail			
Foot			

Appendix 4: Student Graphing Sheet (example)

Graphing Data (D = Dalmatian, P = Pug, B = Bassett Hound)

20 in.							
19 in.							
18 in.							
17 in.							
16 in.							
15 in.							
14 in.							
13 in.							
12 in.							
11 in.							
10 in.							
9 in.							
8 in.							
7 in.							
6 in.							
5 in.							
4 in.							
3 in.							
2 in.							
1 in.							
	D	P	B		D	P	B
	[NOSE + MUZZLE]				[FACE]		

Graphing Data (**D** = Dalmatian, **P** = Pug, **B** = Bassett Hound)

20 in.							
19 in.							
18 in.							
17 in.							
16 in.							
15 in.							
14 in.							
13 in.							
12 in.							
11 in.							
10 in.							
9 in.							
8 in.							
7 in.							
6 in.							
5 in.							
4 in.							
3 in.							
2 in.							
1 in.							

D **P** **B** **D** **P** **B**

[**EAR**]

[**TORSO**]

Graphing Data (**D** = Dalmatian, **P** = Pug, **B** = Bassett Hound)

20 in.							
19 in.							
18 in.							
17 in.							
16 in.							
15 in.							
14 in.							
13 in.							
12 in.							
11 in.							
10 in.							
9 in.							
8 in.							
7 in.							
6 in.							
5 in.							
4 in.							
3 in.							
2 in.							
1 in.							

D

P

B

D

P

B

[**NECK**]

[**UPPER LEG**]

Graphing Data (**D** = Dalmatian, **P** = Pug, **B** = Bassett Hound)

20 in.							
19 in.							
18 in.							
17 in.							
16 in.							
15 in.							
14 in.							
13 in.							
12 in.							
11 in.							
10 in.							
9 in.							
8 in.							
7 in.							
6 in.							
5 in.							
4 in.							
3 in.							
2 in.							
1 in.							

D **P** **B** **D** **P** **B**

[**LOWER LEG**]

[**TAIL**]

Graphing Data (**D** = Dalmatian, **P** = Pug, **B** = Bassett Hound)

20 in.							
19 in.							
18 in.							
17 in.							
16 in.							
15 in.							
14 in.							
13 in.							
12 in.							
11 in.							
10 in.							
9 in.							
8 in.							
7 in.							
6 in.							
5 in.							
4 in.							
3 in.							
2 in.							
1 in.							

D **P** **B** **D** **P** **B**

[**FOOT**]

Appendix 5: Student Math Story Problems to Compare Measurements

COMPARISON MEASUREMENT STORY PROBLEMS

<p>A.</p> <p>How much shorter is a Bassett Hound's upper leg compared to a Dalmatian's upper leg?</p>	<p>B.</p> <p>How many more inches is a Dalmatian's torso than a Pug's torso?</p>
<p>C.</p> <p>How much longer is a Dalmatian's nose and muzzle compared to a Pug's nose and muzzle?</p>	<p>D.</p> <p>How much longer is a Bassett Hound's torso than the length of its ear?</p>
<p>E.</p> <p>How many more inches long is a Dalmatian's torso than the length of its tail?</p>	<p>F.</p> <p>How much shorter is a Pug's neck than a Bassett Hound's ear?</p>

<p>G. Add the lengths of a Dalmatian's upper and lower leg. Add the lengths of a Pug's upper and lower leg. Which breed of dog has the longest whole leg? How much longer is it?</p>	<p>H. How much longer is a Bassett Hound's torso than its own neck?</p>
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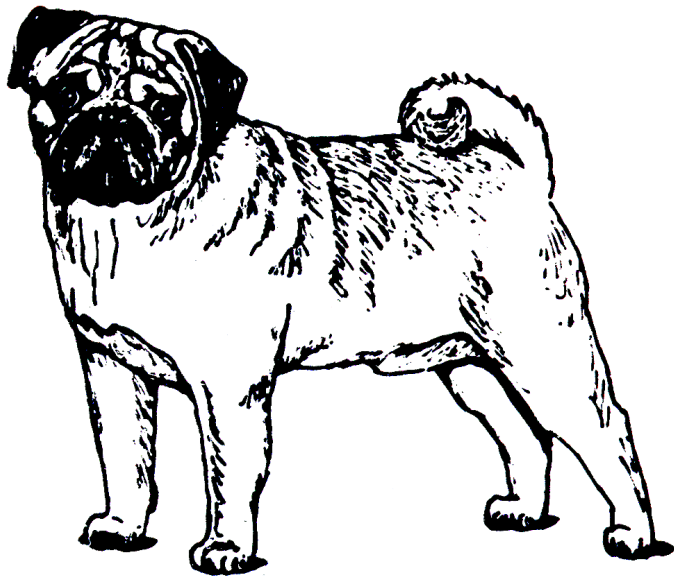
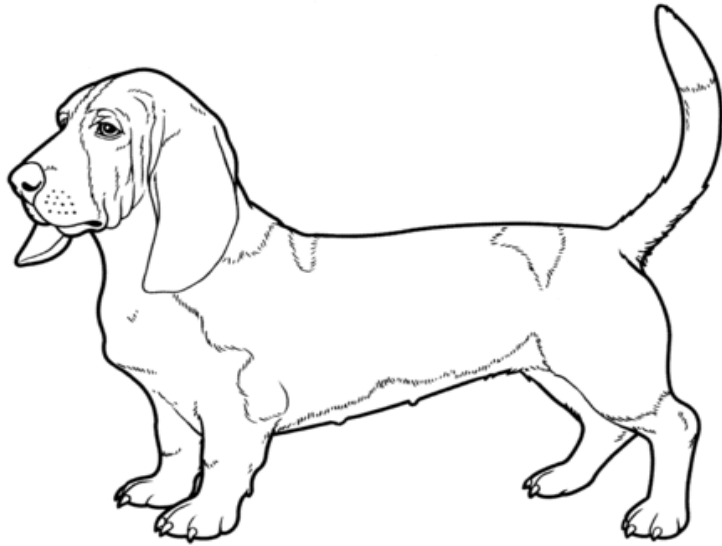
ADDITION and SUBTRACTION MEASUREMENT STORY PROBLEMS
USING AN OPEN NUMBER LINE.

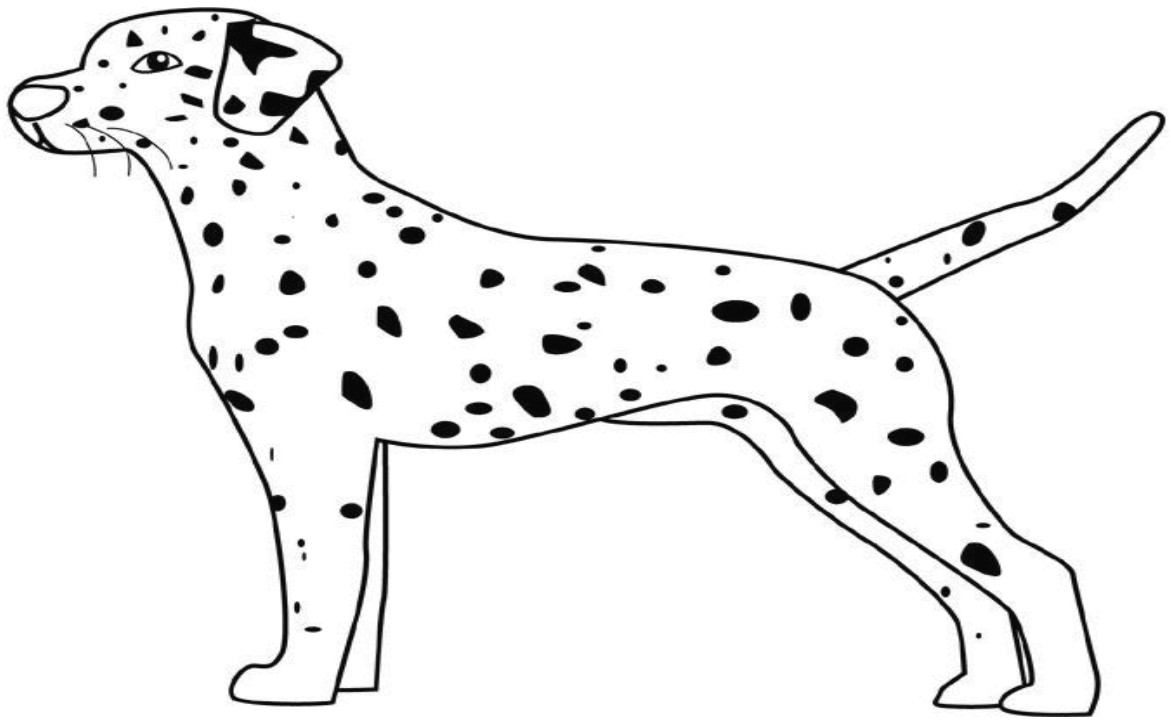
<p>A. How many inches long is a Dalmatian's torso, Pug's torso, and Bassett Hound's torso altogether?</p>	<p>B. A Pug's tail is 6 inches long. How many more inches does it need to be the same length as a Bassett Hound's tail?</p>
<p>C. The face of a Pug is 5 inches long. How many more inches need to be added until it is the same length as a 23-inch snake?</p>	<p>D. How many inches need to be cut from a 24-inch rope to be the same length as a Bassett Hound's neck?</p>

<p>E.</p> <p>If added together, how many total inches would all the body parts of a Pug equal?</p>	<p>F.</p> <p>The length of a goat is 64 inches. The length of a Bassett Hound is 35 inches. How much longer is a goat than a Bassett Hound?</p>
<p>G.</p> <p>The length of a small cow is 98 inches. The length of a Pug is 26 inches. How much shorter is a Pug than a cow?</p>	<p>H.</p> <p>The length of a Bassett Hound's upper leg is 4 inches. How many more inches until it would be 32 inches long?</p>

Appendix 6: Dog Pictures

1. Bassett Hound
2. Pug
3. Dalmatian





Teacher Resources

<http://www.dpi.state.nc.us/docs/curriculum/mathematics/scos/current/2nd-unpacking.pdf>

<https://evilcloud.co.uk/electronic~diagram-of-dog-body.html>

<https://dogtime.com/dog-breeds/profiles>

Notes

¹"Why Do Kids Prefer Dogs to Siblings? Biophilia." Fatherly. August 27, 2017. Accessed September 15, 2018. <https://www.fatherly.com/health-science/kids-prefer-dogs-siblings/>.

² Ibid.

³ Ibid.

⁴ Ibid.

⁵ Ibid.

⁶ Ibid.

⁷ "Pets Are a Child's Best Friend, Not Their Siblings." University of Cambridge. January 26, 2017. Accessed September 15, 2018. <https://www.cam.ac.uk/research/news/pets-are-a-childs-best-friend-not-their-siblings>.

⁸ Ibid.

⁹ Ibid

¹⁰ "Why Do Kids Prefer Dogs to Siblings? Biophilia." Fatherly. August 27, 2017. Accessed September 15, 2018. <https://www.fatherly.com/health-science/kids-prefer-dogs-siblings/>.

¹¹ "Biophilia Hypothesis." Wikipedia. August 17, 2018. Accessed September 15, 2018. https://en.wikipedia.org/wiki/Biophilia_hypothesis.

¹² "Dogs' Intelligence On Par With Two-year-old Human, Canine Researcher Says." ScienceDaily. August 10, 2009. Accessed September 15, 2018. <https://www.sciencedaily.com/releases/2009/08/090810025241.htm>.

¹³ Ibid

¹⁴ Ibid

¹⁵ "Why Do Kids Prefer Dogs to Siblings? Biophilia." Fatherly. August 27, 2017. Accessed September 15, 2018. <https://www.fatherly.com/health-science/kids-prefer-dogs-siblings/>.

¹⁶ Ibid.

¹⁷ Strickland, Bill. "The Benefits of Pets." Parents. Accessed September 15, 2018. <https://www.parents.com/parenting/pets/kids/the-benefits-of-pets/>.

¹⁸ Ibid

¹⁹ Ibid

²⁰ Purewal, Rebecca, Robert Christley, Katarzyna Kordas, Carol Joinson, Kerstin Meints, Nancy Gee, and Carri Westgarth. Current Neurology and Neuroscience Reports. March 2017. Accessed September 15, 2018. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5369070/>.

²¹ Herzog, Hal. "Why People Care More About Pets Than Other Humans." Wired. June 03, 2017. Accessed September 15, 2018. <https://www.wired.com/2015/04/people-care-pets-humans/>.

²² Ibid.

²³ Herzog, Hal. *Some We Love, Some We Hate, Some We Eat*. 2011.

²⁴ Ibid.

²⁵ Ibid.

²⁶ Ibid.

²⁷ Ibid.

²⁸ Ibid.

²⁹ "10 Reasons Pets Are Good for Kids." Oprah.com. Accessed September 15, 2018. <http://www.oprah.com/relationships/10-reasons-pets-are-good-for-kids>.

³⁰ Mattinson, Pippa, and Pippa MattinsonDog. "Dog Shape - Exploring the Variety of Dog Types and Body Shapes." The Happy Puppy Site. March 21, 2018. Accessed September 15, 2018. <https://thehappypuppysite.com/dog-shape/>.

³¹ Ibid.

³² Ibid.

³³ Ibid

³⁴ Mattinson, Pippa, Pippa MattinsonDog, Naomi, Kate Ramsden, Pippa, and Terrie Barr. "Brachycephaly In Dogs: What It Means to Be A Brachycephalic Puppy." The Happy Puppy Site. August 24, 2016. Accessed September 15, 2018. <https://thehappypuppysite.com/brachycephaly-in-dogs/>.

³⁵ "A Dog's Size and Head Shape Predicts Its Behavior." Psychology Today. Accessed September 15, 2018. <https://www.psychologytoday.com/us/blog/canine-corner/201603/dogs-size-and-head-shape-predicts-its-behavior>.

³⁶ Ibid.

³⁷ Ibid.

³⁸ Ibid

³⁹ Ibid.

⁴⁰ "Which Dog Breeds Are the Fastest?" CANIDAE®. Accessed September 15, 2018. <https://www.canidae.com/blog/2012/08/which-dog-breeds-are-fastest/>.

⁴¹ "A Dog's Size and Head Shape Predicts Its Behavior." Psychology Today. Accessed September 15, 2018. <https://www.psychologytoday.com/us/blog/canine-corner/201603/dogs-size-and-head-shape-predicts-its-behavior>.

⁴² <https://en.wikipedia.org/wiki/Dachshund>

⁴³ <https://en.wikipedia.org/wiki/Pug>

Bibliography

"10 Reasons Pets Are Good for Kids." Oprah.com. Accessed September 15, 2018.

<http://www.oprah.com/relationships/10-reasons-pets-are-good-for-kids>.

This short article lists positive reasons for parents to consider when getting a pet for their child.

"A Dog's Size and Head Shape Predicts Its Behavior." Psychology Today. Accessed September 15, 2018. <https://www.psychologytoday.com/us/blog/canine-corner/201603/dogs-size-and-head-shape-predicts-its-behavior>.

This article explains the research results from standardized behavioral tests done on different breeds of dogs. Based on these findings, researchers suggest that a dog's weight, height, and head shape are correlated to its personality and engagement with humans.

"Biophilia Hypothesis." Wikipedia. August 17, 2018. Accessed September 15, 2018.

https://en.wikipedia.org/wiki/Biophilia_hypothesis.

The contents explain the definition of biophilia and gives examples of this concept in different aspects in our society. It also references other books written by authors well informed on the subject.

"Dogs' Intelligence On Par With Two-year-old Human, Canine Researcher Says." ScienceDaily. August 10, 2009. Accessed September 15, 2018.

<https://www.sciencedaily.com/releases/2009/08/090810025241.htm>.

The author has written several books on the behavior of dogs. He explains how dogs have three different types of intelligences: instinctive, adaptive, and working – and how each of these intelligences can be comparable to the mental abilities of a toddler.

Herzog, Hal. *Some We Love, Some We Hate, Some We Eat*. 2011.

The book gives unique insight on the relationship humans have with animals, both in the past and today. It includes scientific research combined with anthrozoology.

Herzog, Hal. "Why People Care More About Pets Than Other Humans." Wired. June 03, 2017. Accessed September 15, 2018. <https://www.wired.com/2015/04/people-care-pets-humans/>.

The author retells several real-life reports about the reactions of people over the injustices towards certain animal species. He raises the question about which lives are valued more, animals or humans, and discusses the humanization of dogs as a central part of the article.

Mattinson, Pippa, Pippa MattinsonDog, Naomi, Kate Ramsden, Pippa, and Terrie Barr.

"Brachycephaly In Dogs: What It Means To Be A Brachycephalic Puppy." The Happy Puppy Site. August 24, 2016. Accessed September 15, 2018.

<https://thehappypuppysite.com/brachycephaly-in-dogs/>.

The information is about brachycephaly, or short skulled, dogs and how their physical characteristics affect their energy and health. The author discusses how owners should research and consider the needs of these types of dogs to decide if they are the right companions.

Mattinson, Pippa, and Pippa MattinsonDog. "Dog Shape - Exploring The Variety Of Dog Types And Body Shapes." The Happy Puppy Site. March 21, 2018. Accessed September 15, 2018. <https://thehappypuppysite.com/dog-shape/>.

The importance of body shape, as well as other unique characteristics, should be well researched before deciding if the dog and owner are compatible.

"Pets Are a Child's Best Friend, Not Their Siblings." University of Cambridge. January 26, 2017. Accessed September 15, 2018. <https://www.cam.ac.uk/research/news/pets-are-a-childs-best-friend-not-their-siblings>.

This study explains the results of a survey done in 77 families suggesting that children prefer the companionship of pets compared to their own siblings. It also discusses how boys and girls differ in their relationships with their pets.

Purewal, R., R. Christley, K. Kordas, C. Joinson, K. Meints, N. Gee, and C. Westgarth. "Companion Animals and Child/Adolescent Development: A Systematic Review of the Evidence." Current Neurology and Neuroscience Reports. February 27, 2017. Accessed September 15, 2018. <https://www.ncbi.nlm.nih.gov/pubmed/28264460>.

This research explains how pets and companion animals can improve the emotional health, self-esteem, and cognitive abilities in children and adolescents.

Purewal, Rebecca, Robert Christley, Katarzyna Kordas, Carol Joinson, Kerstin Meints, Nancy Gee, and Carri Westgarth. Current Neurology and Neuroscience Reports. March 2017. Accessed September 15, 2018. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5369070/>. This research explains the importance of animals as companions in the social and emotional development of children and adolescents.

Scully, Simone M. "9 Special Abilities That Show How Smart Dogs Really Are." Business Insider. August 15, 2016. Accessed September 15, 2018. <https://www.businessinsider.com/special-abilities-that-show-how-smart-dogs-are-2016-8>. This article is about how dogs have similar cognitive abilities to very young children, and how these abilities can be strengthened with training and continuous interactions with humans

Strickland, Bill. "The Benefits of Pets." Parents. Accessed September 15, 2018. <https://www.parents.com/parenting/pets/kids/the-benefits-of-pets/>. This short article explains how pets can help children learn, feel safe, encourage nurturing, and help them form bonds with other animals and human beings.

"Which Dog Breeds Are the Fastest?" CANIDAE®. Accessed September 15, 2018. <https://www.canidae.com/blog/2012/08/which-dog-breeds-are-fastest/>. This resource provides facts about how fast different breeds of dogs can run due to the physical structures of their body.

"Why Do Kids Prefer Dogs to Siblings? Biophilia." Fatherly. August 27, 2017. Accessed September 15, 2018. <https://www.fatherly.com/health-science/kids-prefer-dogs-siblings/>. The article supports why some children prefer having a relationship with a pet, specifically a dog, compared to a sibling or parent.

"Why Kids With Pets Are Better Off." Psychology Today. Accessed September 15, 2018. <https://www.psychologytoday.com/us/blog/animals-and-us/201707/why-kids-pets-are-better>. This article gives several examples as to why pets improve the lives of children - socially, emotionally, and cognitively.

Wikipedia: <https://en.wikipedia.org/wiki/Dachshund>
This entry in Wikipedia provides general information about Dachshunds. It describes the physical characteristics and behavior traits of a Dachshund, the general health of this type of dog, and a brief history of the breed.

Wikipedia: <https://en.wikipedia.org/wiki/Pug>
This entry in Wikipedia provides general information about Pugs. It describes the physical characteristics and behavior traits of a Pug, the general health of this type of dog, and a brief history of the breed.