Science Assessment System Through Course Task

Bundles of Joy

Grade Levels:
4

Phenomena:
Relationships Between Size, Gestation Period, Life Span

Science & Engineering Practices:
Analyzing and Interpreting Data
Engaging in Argument from Evidence

Crosscutting Concepts:
Patterns

Designed and revised by Kentucky Department of Education staff
in collaboration with teachers from Kentucky schools and districts.

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Preparing to implement Through Course Tasks in the Classroom

What is a TCT?

- TCTs are 3-dimensional tasks specifically designed to get evidence of student competency in two dimensions, Science and Engineering Processes (SEPs) and Crosscutting Concepts (CCC), untethered from Performance Expectations (PEs)/standards. Tasks are sense-making experiences.
- Tasks are to be used formatively. The goal is for both students and teachers to understand areas of strength and improvement for the SEP(s) and CCC assessed within the task.

How do I facilitate a Through Course Task (TCT)?

- TCT facilitation is a collaborative process in which teacher teams calibrate understanding of the expectations of the task and refine strategies to be used during task facilitation.

Before the task:

1. Complete the TCT as a learner – compare understanding of task through the lens of success criteria (identified in the task) in order to understand expectations.
   Success criteria include:
   - What is this task designed to get evidence of?
   - What is the task asking the students to do?
   - What might a student response look like?
2. Identify the phenomenon within the task. Consult resources to assure teacher teams have a deep understanding of associated science concepts.
3. Collaborate to generate, review and refine feedback questions during facilitation.
4. Identify potential "trouble spots" and plan for possible misconceptions.

During the task:

5. Collect defensible evidence of each student's competencies in 3-dimensional sense-making for the task.
6. Ask appropriate feedback questions to support student access and engagement with the task in order to elicit accurate evidence of student capacities.

After the task:

7. Reflect on the task as a collaborative team.
8. Review student work samples to identify areas of strength and areas of need.
9. Determine/plan next steps to move 3-D sense making forward through the strengthening of the use of SEPs and CCCs.

Using the materials included in this packet:

- **Task Annotation:**
  - The task annotation is a teacher guide for using the task in the classroom. Additionally, the annotation gives insight into the thinking of developers and the task overall.

    - Each task has science and engineering practices, disciplinary core ideas, and crosscutting concepts designated with both color and text style:
        - **Science and Engineering Practices**
        - *Disciplinary Core Ideas*
        - Crosscutting Concepts
- **Student Task:** The materials to be used by students to complete the TCT.

Bundles of Joy Task Annotation

After analyzing and interpreting data about *relationships between animal size, gestation period, and lifespan*, **critique arguments about what the data reveal**, based on patterns as **evidence for your reasoning in your critique.**

Overall Intent

The task is intended to measure a students' ability to select between two given claims and provide an evidenced based explanation for their selection supported by patterns they identify in the data.

Phenomenon within the task

The phenomenon within the task relates to differences in gestation period, lifespan and average size of nine different animals. The provided information indicates that smaller animals have shorter gestation period (relevant to life cycles) and larger animals live longer and that overall, that larger animal outlive smaller animals. (For further information on this phenomenon, see "Rate of Living Theory" by Max Rubner, 1908.)

Ideas for setting up the task with students

Prerequisite:

- Students should have had experience:
  - analyzing and interpreting the data to identify patterns as well as irregularities in data
  - analyzing and interpreting data in various bar graphs
  - using data provided in table format to create a visual representation, such as a bar graph
  - interpreting and creating grade appropriate horizontal bar graphs similar to the ones used in the task
- Students should have had opportunities to reason with evidence in order to support an explanation or claim.
- The terms ***gestation, incubation*** and ***lifespan*** should be discussed as it relates to the life cycles of animals. Most female mammals carry their developing babies inside their bodies until the time the babies are born which is called the gestation period. Incubation is the time an organism develops within an egg, outside of the mother (https://www.youtube.com/watch?v=l_D1qTNDyJc). In order to avoid perpetuating any misconceptions about the period of

time it takes a chicken to hatch from an egg as being "the gestation period of a chicken," it is recommended that you share information related to both incubation and gestation. Students could brainstorm lists of animals that hatch from an egg and those that develop within the mother which might lead to the realization that only one animal hatches and how this could skew the data.

- **With that said, it is important to focus on the intent of the task.** Students are asked to analyze **the provided data**, be it correct or flawed, as evidence to support a claim. Facilitating discussions that lead to further understanding of reliable data is essential for all students. This task presents opportunities to have rich conversations about the issues with the data set. Gestation vs incubation is just one topic for discussion.
- Close analysis of the data set also reveals issues in the recorded life span of the animals. Further research by students can support foundational understanding related to reliable sources (aligned with ELA standards as well).

It is recommended that you encourage the students to uncover these issues through careful questioning rather than give direct statements as to what is wrong with the data set. Facilitate discussion that leads student to do the deep thinking!

Intent of the Task for Assessment

- The intent of this task is to elicit students' ability to provide a reasoned explanation for selecting one claim over another as being the one that is best supported by the patterns they observe within provided data. Students are given a table and a corresponding bar graph to interpret. They are asked to identify any patterns they notice between the size of an animal and length of the gestation period. This is not an assessed component of the task, rather it intended to promote student engagement with the data. Students should conclude that there is a pattern in the relationship between the size of an animal and the animal's gestation period. This pattern holds true for all of the animals except the whale and the elephant. A whale is bigger than an elephant yet the gestation period for an elephant is longer than that of a whale.
- Next, students convert data from a table into a graph in a similar fashion to the information they just analyzed. This time, students complete the graph with a new set of data (the lifespan of the animal). There are inconsistencies in the relationship between an animal's gestation period and its lifespan in this data set.
- By synthesizing the information provided in these two different sets of data, students are more likely to be able to identify which of two claims can best be supported using patterns in the data and cite those patterns in justifying their reasoning.

- Note: It should be noted that students are not only asked to provide a reasoned explanation for one claim being better than the other, but are encouraged to explain the deficiencies in the other claim. Having students share their reasoning in this manner reveals whether or not a student could identify the patterns in the data and reason with the evidence.
- After analyzing the data to find evidence to support one claim as better supported than the other, students may conclude that both claims could be supported based on evidence in the data. It will be necessary for students to provide strong reasoning for why they feel one claim is better supported by the patterns in the data than the other.

Success Criteria

Evidence of Learning Desired based on Progression from Appendices

Analyzing and interpreting Data (Appendix F):

- Represent data in tables and or graphical displays to reveal patterns that indicate relationships.

Engaging in Argument from Evidence (Appendix F):

- Support an argument with evidence from data.

Patterns (Appendix G):

- Patterns can be used as evidence to use to support an explanation (claim).

Success Criteria

Students construct an argument for one of two claims based on:

- analysis of given data
- identified patterns in the data
- reasoning through the use of patterns
- identified patterns in the data as evidence to support the claim

Possible Student Responses

Students may conclude that either claim can be supported with evidence found in the data since patterns can be identified in both sets. Emphasis should be placed on the evidence students provide and their ability to reason with the evidence.

Sample student response:

I believe that Maria's claim is better supported by patterns found in the data. On the graph starting with the rat all the way up to horse there is a pattern between the size of the animal and the length of their gestation period. The number of days increases with the size of the animal until you get to the elephant and the whale. The whale is bigger but it has a shorter gestation period than the elephant. This is where the consistent pattern stops. The elephant's gestation period is longer than the whale's, and the whale is a much larger animal than the elephant.

I did not select Tom's claim because I don't think the pattern is as consistent as the pattern Maria observed. In the information we were given, there is a pattern between the gestation period and the lifespan of the animals but it has more inconsistencies than Maria's claim. From the rat to the human, the lifespan increases and the gestation period does too. After that there are a few more differences like the human living longer than the elephant but the elephant's gestation period is longer than the humans. Or, the whale's gestation period is shorter than the elephant's but the whale lives longer. The animal with the longest lifespan is the whale and the whale does not have the longest gestation period.

Extensions and/or other uses after the task is implemented

There are a variety of tasks and extensions from the work performed in this TCT.

- Supporting reason with evidence is a cross-curricular theme. Students can build skills in this experience to enhance their ability to justify their thinking in ELA and Mathematics tasks.
- Students can research the length of other animal gestation periods and explore whether the pattern presented in the data holds true to other animals. Students can make predictions about animals using the data from the TCT, such as a mouse (which is smaller than a rat) or a giraffe (which is larger than a horse). Students can discover the predictable nature of patterns and apply this thinking to other curricular areas.
- Students identify patterns in data, but discover that not all patterns are perfect. In this TCT, there is a pattern between the size of the animal and the gestation period, except in the case of the whale and the elephant. Some students referred to this as a "pattern buster." Students will enjoy investigating other "pattern busters" in science such as mammals that lay eggs, reptiles that have live birth, etc.
- Students complete and use a bar graph in this TCT. The purpose of constructing the graph was to assist students in "seeing" the data from the table, comparing the data found in both graphs, and identifying patterns. We found that students have

experience in reading graphs, but can lack experience in creating graphs. There are many types of graphs students can analyze and produce. One extension is to take the data from the TCT and model the creation of graphs using a spreadsheet. The graphs are easy to produce and students can toggle from one type of graph to another to see how the data is represented. Representing data can be featured in each area of science and the increased experience in reading and producing graphs will build a better understanding of concepts of size and scale.

- Encourage students to gather the same data on different organism and then have small groups construct graphs and analyze the data to make comparisons.

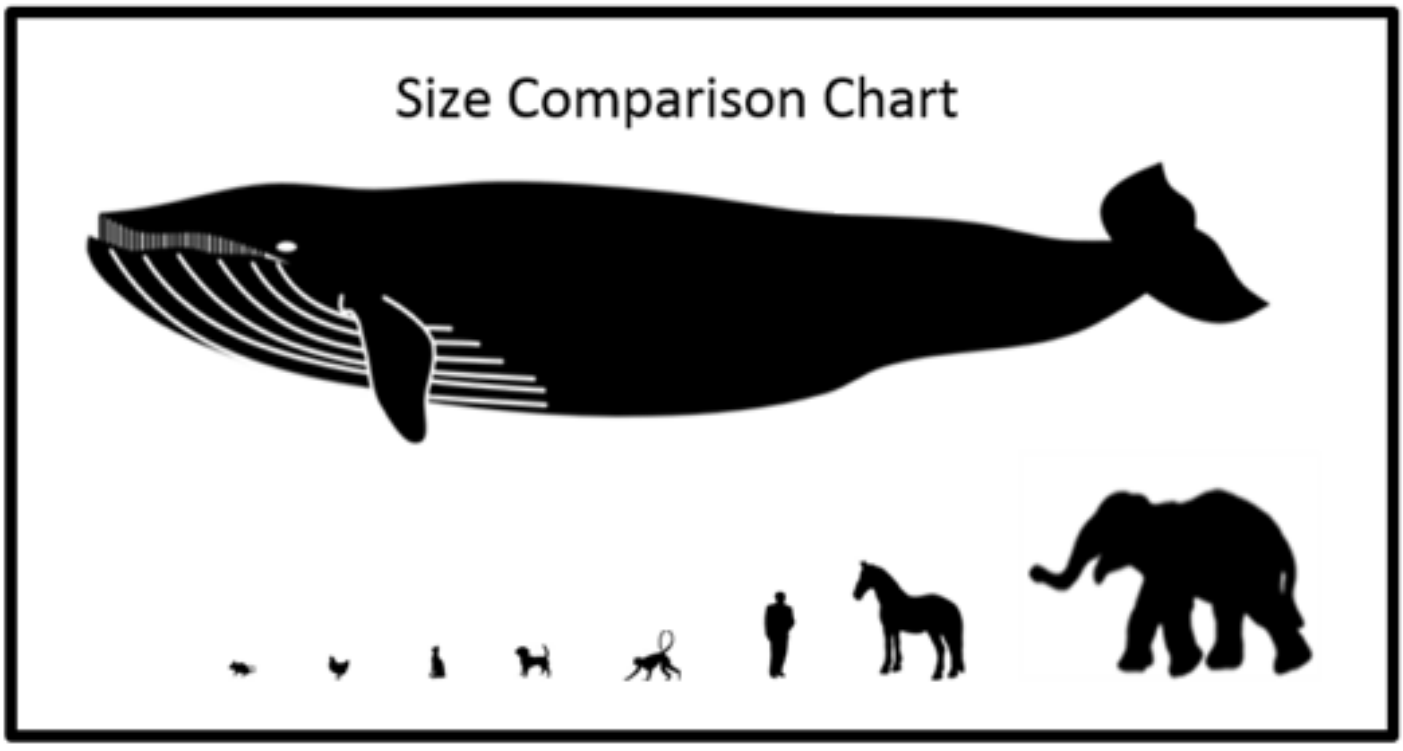
Through Course Task – Bundles of Joy

Name:_____ Date:_____

Scenario:

Students observed chickens hatching from eggs in their classroom. They noted that it took 22 days from the time the chickens laid the eggs until they hatched. The students learned that the length of time it takes an organism to develop before being born is called the ***gestation period*** *(known as incubation period of the organism hatches from an egg)*. Students wondered if all animals have a gestation period of 22 days. The class researched the gestation period of the animals shown below.

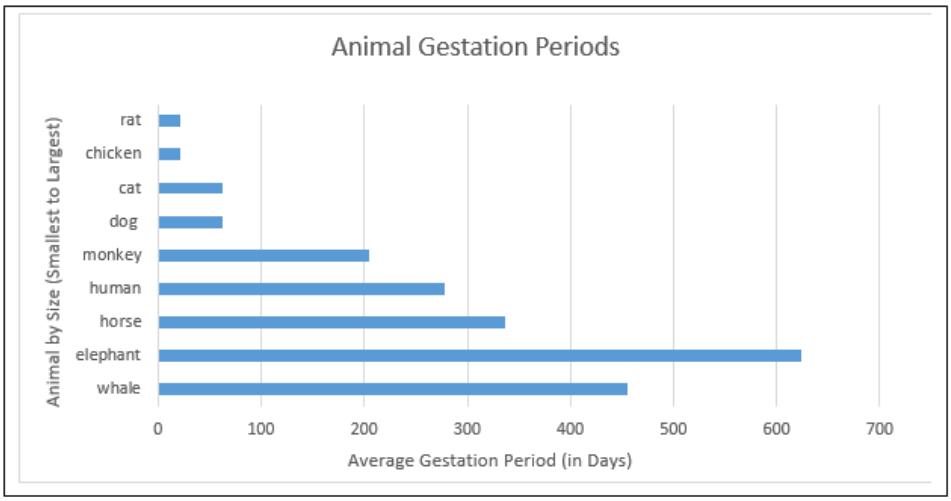
The students recorded their findings in the following table. Next, they created a bar graph based on the information in the table to show the relationship between the size of the animal and the animal's gestation period.



Study the information provided in the two graphs, then answer the following question.

Gestation Period Data Table

Animal according to size	Average Gestation Period (in Days)
Rat	21
Chicken	22
Cat	63
Dog	63
Monkey	205
Human	278
Horse	336
Elephant	624
Whale	456



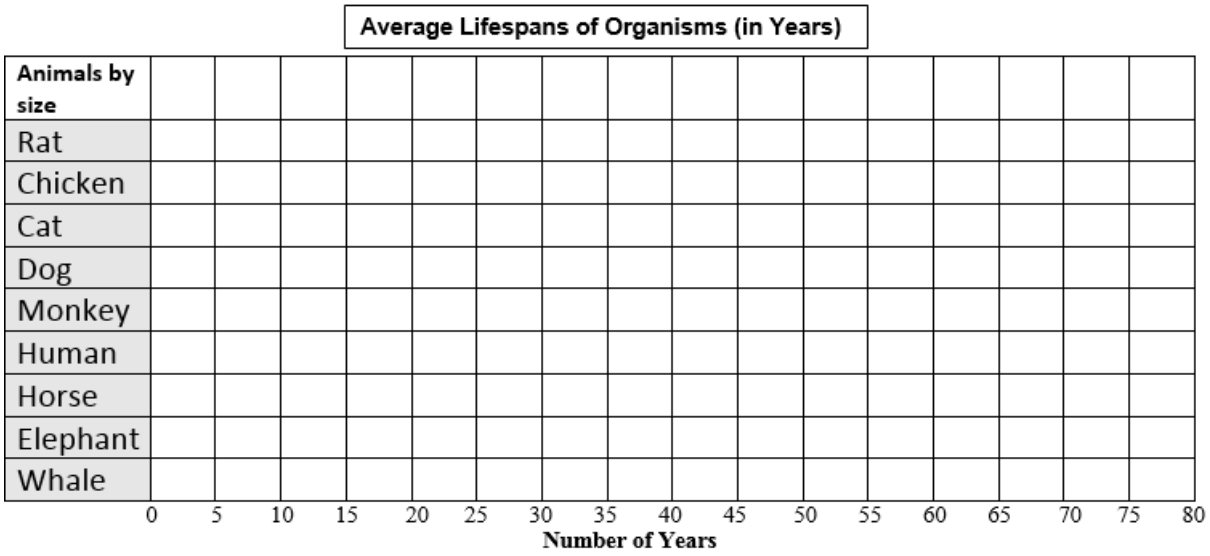
1. *Describe any patterns you see between the animal's size and the length of the animal's gestation?*

As students discussed their findings, one classmate wondered aloud about the **lifespan** of the animals in the chart. They wanted to know how long the animals lived. This prompted other students to research the average lifespan of each animal recorded on the chart. Their findings are organized in the data table shown below.

The students decided it would be easier to interpret the information provided in the table by creating a bar graph using the same information, so they started a bar graph.

2. *Using the information in the students' data table, complete the bar graph and compare the average lifespan of the animals.*

Animals according to size	Average Lifespan (Years)
Rat	1.8
Chicken	8
Cat	10
Dog	10
Monkey	12
Human	67
Horse	20
Elephant	30
Whale	80



Study the bar graph you completed. Consider any patterns that may be evident between the gestation period of the animal (animals are listed by the shortest gestation period to the longest) and the **lifespan of the animal**.

3. *Record your observations after analyzing the information in the* **Average Lifespans of Organisms** *bar graph.*

After analyzing the data in both bar graphs (Gestation Period of Animals & Average Lifespan of Animals), two students discussed patterns they observed.

Tom claimed, "I see a pattern in the data that shows a relationship between gestation period and the lifespan of the animal. As an animal's gestation period gets longer, the lifespan of the animal gets longer, too."

Maria commented, "It seems there is a better pattern between the size of the animal and the gestation period of the animal. The bigger an animal is, the longer the gestation period it has."

Carefully consider each of the student's claims. Determine what information in the data can be used as evidence to support either Tom's or Maria's claim. Be sure to review both graphs carefully!

4. *Identify the claim, Tom or Maria's, that is best supported by patterns in the data. Use patterns observed in the data as evidence to support why you chose the claim.*