Ready, Set, Go!

Increasing the Speed of Our Bearded Dragon

Adapted from	**https://petsintheclassroom.org/wp-content/uploads/2017/08/Celebrating-the-Speed-of-Our-Bearded-Dragon.pdf**
Pet: **Bearded dragon**	**Class:** **3-5**

Brief Overview: Students use their understanding of forces and motion to design and build a device that encourages their bearded dragon to increase his speed.. They calculate speed, analyze distance/time graphs, and apply engineering principles to create solutions. This lesson is adaptable to other pets and other grades.	**Lesson Breakdown** **Lesson 1:** What is speed? **Lesson 2:** Gathering Baseline Data **Lesson 3:** Build Your Device **Lesson 4:** Gathering and Analyzing the Data
Essential Question How can we use our understanding of forces and motion to design a device that influences our bearded dragon's movement?	

Subjects ☑ **Science** ☑ **ELA** ☑ **Math** ☑ **STEM** ☐ **Art** ☐ **Other**	**Stem Connections** Science: light,sound,motion, physical science Technology: stopwatches, laser pointers Engineering: creation of device Math: calculator of speed, velocity, measurement, graphing

Performance Expectations/ Standards
NGSS

5-PS2.A: Motion and Stability: Forces and interactions cause objects to change their position (motion) and speed.

5-E4.A: Engineering Design: Define a problem, design a solution, test, and improve.

CCSS

Math: 5.MD.1 Convert among different-sized standard measurement units within a given measurement system (e.g., convert 5 cm to 0.05 m), and use these conversions in solving multi-step, real world problems.

5.NBT.B.7 Add, subtract, multiply, and divide decimals to hundredths, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method and explain the reasoning used.

ELA:

W.5.2.D: Use precise language and domain-specific vocabulary to inform about or explain the topic.

I CAN statements

- calculate the speed of an object using distance and time.
- interpret and analyze distance/time graphs.
- design and build a device to influence an object's movement.
- explain how forces and motion principles influence my design.

Materials

- Ready, Set Go! Student Worksheet
- Calculating Speed Task Cards
- Bearded dragon (or other pet)
- Meter sticks
- stopwatches
- Calculators
- Building supplies: cardboard, scissors, glue, tape, laser pens, paper towel tubes, etc.

Teacher Background

Speed is a fundamental concept in physics that describes the rate at which an object changes its position. It is a scalar quantity, meaning it has only magnitude (how fast) and no direction (which way). Here's a breakdown for effective teaching:

Definitions:

- **Speed** = Distance traveled / Time taken (S = D/T)
- **Units:** Typically measured in meters per second (m/s) or kilometers per hour (km/h).
- **Scalar vs. Vector**: Differentiate speed from velocity, a vector quantity that includes both magnitude (speed) and direction.
- **Average vs. Instantaneous**: Explain the difference between average speed (calculated over a specific time interval) and instantaneous speed (describing the object's motion at a particular moment).
- **Calculating Speed**: Emphasize that distance and time are measured before calculating speed.
- **Relativity:** Introduce the concept that speed is relative to a reference point.

Lesson 1: What is speed?		
Time	**Materials**	**Activity**
5 mins		Review with students inertia and Newton's First Law of Motion. Remind them that a force is a push or a pull, and forces cause changes in an object's motion.
25 mins	Calculating Speed Task Cards Calculators	Review with students the formula for calculating speed (distance ÷ time) Students will practice calculating speed with simple word problems on task cards. One task card will be on each desk. Students will solve one problem at a time. They will record their answers on their answer sheets. Students will move to the next task card when the teacher rings the chime/bell.

		*Students who need a multiplication chart or calculator can use them for this activity. After all students have solved all speed problems, go over the answers.

Lesson 2: Gathering Baseline Data		
Time	**Materials**	**Activity**
5 mins	Stopwatch Tape Meter Stick Calculator	Read through the directions in the Student Worksheet with the students. 1. One team member will put a piece of tape on the floor where the bearded dragon starts (by the tip of his tail). 2. One team member will start the stopwatch once the bearded dragon starts running. 3. Stop the stopwatch when the bearded dragon stops moving. Record the time in the table below. 4. Measure the distance bearded dragon traveled and record the distance in the table. *Measure to the tip of his tail. 5. Calculate the speed. Divide the distance by the time. Record the speed in the table. 6. Repeat this process for all three trials. 7. Calculate the average of the speeds. (Round to the nearest tenth.)
40 mins	Ready, Set Go! Student Worksheet	Get the bearded dragon ready to run! *Note: Safe handling of pets is the most important part of this experiment. To prevent fatigue of the bearded dragon, you may wish to spread out the testing over several days*

Lesson 3: Build Your Device		
Time	**Materials**	**Activity**

Lesson 3: Build Your Device		
5 mins	Ready, Set Go! Student Worksheet	Explain the "engineering challenge": design and build a device that makes the bearded dragon move more quickly.
15 mins	Ready, Set Go! Student Worksheet	Allow the students time to brainstorm and design their devices. Have them share their designs with you before building so that you can ensure the device is safe for the bearded dragon. Safe, ethical treatment of the animal is paramount. Students struggling? Here are some ideas: **1. Ramp and Target**: Build a gently inclined ramp leading to a target with a favorite treat placed on it. Will the angle of the ramp and the distance to the target influence his speed? **2. Moving Obstacle Course:** Design a simple obstacle course with gentle slopes, tunnels, and platforms connected by smooth surfaces. This encourages the bearded dragon to explore, climb, and navigate, applying different forces to move around the obstacles . **3. Light Chaser:** Attach a small, lightweight object with a bright LED light to a string. Move the string in front of the bearded dragon, attracting his attention and prompting him to follow the light, influencing his direction and speed. **4. Sound Lure:** Play short recordings of crickets or other interesting sounds in different locations within the testing area. This stimulates his natural instincts to investigate the sound source, causing him to move towards the perceived location. **5. Mirror Maze**: Create a simple maze using mirrors, encouraging him to explore and navigate based on his visual perception and understanding of reflection. This incorporates spatial reasoning and movement patterns. **6. Scent Trail:** A gentle trail of a safe and enticing scent (e.g., diluted fruit puree) guides the bearded dragon along a specific path

Lesson 3: Build Your Device		
		7. **Basking Incentive:** Create a miniature basking platform that moves gradually closer to a heat lamp, motivating the bearded dragon to follow the warmth and cover the distance **8.Feeding Tube:** Build a tube system with small openings, releasing treats in stages as the bearded dragon pushes through, encouraging him to move the desired distance.
25 mins	Ready, Set Go! Student Worksheet Building supplies: cardboard, scissors, glue, tape, laser pens, paper towel tubes, etc.	Build!

Lesson 4: Gathering and Analyzing the Data		
Time	**Materials**	**Activity**
		Note: Safe handling of pets is the most important part of this experiment. To prevent fatigue of the bearded dragon, you may wish to spread out the testing over several days
35 mins	Ready, Set Go! Student Worksheet Stopwatch Tape Meter Stick Calculator	Repeat the previous experiment. (If time permits to allow three trials for each device, great, but if not, one trial will work!) Have the students record the data for each of the devices tested so they can compare the results.
10 mins	Ready, Set Go! Student	Allow the students to complete the reflection questions and then share their reflections with the class.

	Worksheet	

Differentiation
For students who need additional support:

- Allow students to use a multiplication chart or calculator
- Pre-designed templates: Provide basic device outlines with suggestions for materials and construction steps.
- Group work: Pair students with stronger peers who can offer guidance and support.
- Concrete materials: Offer tactile materials like building blocks or Legos for easier construction.
- Simplified data collection: Guide students through basic measurements and calculations with hands-on activities.
- Visual aids: Use pictures, diagrams, and videos to reinforce key concepts of forces and motion.

For students who need additional challenges:

- Research real-world applications of similar engineering principles in animal behavior studies.
- Research: Encourage them to delve deeper into specific forces (friction, gravity) and their impact movement.
- Real-world applications: Research how similar principles are used in animal tracking devices or rehabilitation tools.
- Coding challenge: Introduce basic coding concepts to program a robotic element within their device.
- Complexity in design: Challenge them to incorporate multiple features (light, sound, ramps) in their device.
- Presentation and explanation: Require them to prepare a detailed presentation explaining their design choices and scientific reasoning.

Assessment				
Category	**4 Points (Mastery)**	**3 Points (Proficiency)**	**2 Points (Developing)**	**1 Point (Emerging)**
Data Collection	Data is accurate and reflects consistent recording and observation.	Data is mostly accurate with minor recording or observation errors.	Data is somewhat accurate but may have inconsistencies or missing values.	Data is inaccurate or incomplete, significantly hindering analysis.
Data Analysis	Identifies clear trends and patterns in the	Identifies some trends and patterns but may	Identifies basic trends but struggles to	Demonstrates minimal understanding of

	data with supporting evidence	lack specific details or examples.	explain or provide supporting evidence.	the data, failing to identify trends or patterns.
Data Analysis	Explains how the data relates to the initial prediction and the engineering challenge goals.	Provides a general explanation of the data's connection to the challenge, but may lack detail or clarity.	Makes an attempt to connect the data and challenge, but the explanation is weak or inaccurate.	Shows limited understanding of the connection between the data and the challenge.
Design and Construction	Device is well-designed, uses appropriate materials, and is clearly related to the challenge goals.	Device is mostly functional and uses appropriate materials but may have minor design flaws.	Device is somewhat functional but has significant design flaws or uses inappropriate materials.	Device is poorly designed, non-functional, or uses unsafe materials.
Design and Construction	Construction is neat, sturdy, and safe for the bearded dragon.	Construction is mostly neat and sturdy but may have minor safety concerns.	Construction is messy, weak, or raises safety concerns for the bearded dragon.	Construction is unsafe or unusable due to significant flaws.
Design and Construction	Device demonstrates creativity	Device shows some creativity	Device lacks creativity	Device shows no creativity.
Group Work	All members actively participate in the design, construction, testing, and analysis phases.	Most members participate actively with occasional instances of uneven participation.	Some members participate passively and rely heavily on others' most of the time.	One or more members rarely contribute or hinder the group's progress.
Group Work	Members communicate effectively, listen to each other's ideas, and work collaboratively to solve problems.	Communication is mostly effective with minor instances of conflict or lack of listening.	Communication is ineffective with frequent conflicts, lack of collaboration, or exclusion of members.	Significant communication issues, lack of collaboration, or exclusion of members prevent productive work.

Extension

- Have students research and design devices for other animals based on their specific movement patterns and needs.
- Invite a local engineer or scientist to discuss their work and answer student questions about forces, motion, and the engineering design process.
- Animal adaptations: Research how different animals have adapted to move efficiently in their environment.
- Biomimicry challenge: Based on their research, have students design devices inspired by animal adaptations for other animals or even humans.
- Classroom exhibit: Create a mini-exhibit showcasing the different devices and explaining the science behind them.
- Community outreach: Share their project with younger students or animal shelters, educating them about forces, motion, and animal care.
- Interdisciplinary connection: Collaborate with art or technology teachers to incorporate artistic elements or digital components into their devices.
- Future careers: Explore careers related to engineering, animal behavior, or scientific research for further inspiration.