In this 5E instructional segment, students will explore how physical attributes contribute to an object's motion and apply this knowledge to build a car.

Student Science Performance

Grade or course: Kindergarten	**Title:**
Topic: Physical Science: Types of Motion	How Does it Move? Move It!

Performance Expectation for GSE:

SKP2. Obtain, evaluate, and communicate information to describe types of motion.

a. Plan and carry out an investigation to determine the relationship between an object's physical attributes and its resulting motion (straight, circular, back and forth, fast and slow, and motionless) when a force is applied. (Examples could include toss, drop, push, and pull.)
b. Construct an argument as to the best way to move an object based on its physical attributes.

Performance Expectations for Instruction:

- Students will explore various types of motion due to an object's physical attributes.
- Students will classify objects based on how they move when tossed, dropped, pushed, and/or pulled.
- Students will determine which is the best way to put an object in motion based on its physical features.

Additional notes on student supports

Materials

Variety of objects for students' exploration: balls, marbles, toy cars, wagons, aluminum cans, paper towel tubes, film canisters, books, blocks, water bottles, wooden cylinders, wind-up toys, yo-yo, slinky, pinwheels, etc.

Items for building a car: water bottles, paper towel tubes, popsicle sticks, rubber bands, CDs, straws, etc., glue/glue sticks, scissors, masking tape/cones, measuring tape

Ramps: Books, rulers, or thin boards

Students will continuously obtain, evaluate, and communicate information. This is not a linear process. Students will communicate through writing and discussions to allow for formative assessment. This benefits the teacher, student, and whole group to guide instruction to clarify misconceptions or extend content.

Engaging Learners	**Phenomenon** Motion is defined as a change in location. Objects that are not in motion will remain at rest. To be put in motion, a force must be applied to an object. A force is described as a push or a pull. The physical attributes of an object determine its motion as a result of an applied force. Consider showing a short video clip of characters that students would be familiar with putting objects in motion. It could show various scenes where the characters are engaged in using force to put items in motion. Examples include a using a seesaw, using a stroller, tearing paper, painting, kicking a ball, eating, riding in a car, surfing, riding a bike, etc.
	Obtaining Students obtain information about motion from the video clip. Give students a variety of objects including objects such as various balls (such as golf, ping pong, foam, etc.), marbles, toys cars, wagons, aluminum cans, paper towel tubes, film canisters, books, blocks, water bottles, wooden cylinders, wind-up toys, yo-yo, spring toys, pinwheels, etc. Students will put each object into motion by either tossing, dropping, pushing and/or pulling it.
	Evaluating

	Students will work in small groups to classify/group objects according to their movement (i.e., straight, circular, back and forth, fast and slow, and motionless). Students will note similarities and differences of objects' physical attributes within each group. Further, students will determine which is the best way to put each object in motion based on its physical attributes. Students will use observable distance traveled as a measure. For example, students may observe that objects with wheels or curved edges roll better than those with straight edges. Teacher may also provide a rope and allow students to try pushing it. Teacher will ask students: What moves best when pulled? What moves best when pushed? Teacher will record students' ideas of things in the classroom that move more easily when they are pushed, pulled, or either way and how they know that.
	Communicating Students will work in small groups to discuss the different types of motion that results when each object is tossed, dropped, pushed, and/or pulled. Students will discuss which action caused each object to move the farthest as well as the physical attributes of the objects in each resulting group.
Exploring	*Obtaining* Students will work in small groups to make a car using common/recyclable items that will travel the greatest distance. Items may include plastic straws, popsicle sticks, cardboard, construction paper, pipe cleaner, foam, index cards, paper towel tubes, etc.
	Communicating In their small groups, students will use the data from the *ENGAGE* activity to discuss the plan for building their car. Each student/student group will draw a blueprint for their car prior to building it.
	Evaluating Race each group's car in an open area such as a clear hallway, gym, and/or outside. Mark a starting point using masking tape or cones. Base results on the distance the car traveled with only one push. As an extension, students may construct an obstacle course and move their cars in many different ways to get it through the course.
	Formative Assessment of Student Learning
Explaining Finalizing Model	*Obtaining* Students will observe the items used to construct their car. Students will revisit the classification of objects based on how they move and their physical attributes.
	Evaluating Students will determine if they need to modify their design based on the race results. Students will compare their car's motion with other groups' cars and use this comparison as a basis for revisions. Students may race their cars again in order to determine if the changes made make the design better.
	Communicating Students will discuss ways in which their design can be improved. Students may amend their blueprint as well as their car's design.
Elaborating Applying Model	**Phenomenon`** Students will watch the roller coaster video clip.

to Solve a Problem	Roller coasters consist of hills, curves, loops and straight-aways. Roller coasters do not have engines and are pulled up hills by motorized chains. Once a roller coaster is at the top of a hill, a special force (gravity) pulls it down. The energy it uses while falling is what makes it go faster and stay in motion. Once the cars go through a loop, it loses some of this energy and begins to slow down. It is fundamental for kindergarten to understand that objects fall down toward the Earth. It is good to use the language, and the teacher can introduce the word gravity as part of the language if needed when having students toss balls or bean bags to each other or a target. Have them notice that the ball always drops or falls down toward the Earth. Have them watch to see if the ball or bean bag falls straight down or makes a curve when it falls down.
	Obtaining Students will watch the video clip, noting the motion of various roller coaster cars as well as how the car moves on the hills, curves, loops, and straight-aways.
	Evaluating Students will build ramps, using classroom items such as books and rulers. Make ramps of varying heights for students to use in order to test how different heights cause different results. Students will make a claim about which ramp will result in the marble traveling the greatest distance. Students will test the ramps by placing a marble on each one and measuring the final distance traveled by marking where it stopped with a piece of tape or small object and measuring it. *Teacher Notes: Students can use standard or nonstandard measurement techniques for their answers.*
	Communicating Students will share a prediction of which ramp will make the marble travel the farthest and discuss why they have chosen it. After the tests, students will discuss whether their guess was right or wrong and suggest reasons for how the shape of each ramp impacted the marble's motion.
Evaluation	***Assessment of Student Learning***
	In their Science journals/notebooks, students will complete the following statement for each group of items based on physical attributes: *Objects that are (physical attributes such as round, have straight edges, etc.) move (in a straight line, a circle, back and forth, fast/slow). They move best when (type of motion such as tossed, dropped, pushed or pulled).*
SEP, CCC, DCI	**Science Essentials**
Science and Engineering Practices	• Planning and carrying out investigations • Engaging in argument from evidence • Obtaining, communicating, and evaluating information
Crosscutting Concepts	• Patterns • Cause and Effect • Energy and Matter
Disciplinary Core Ideas	From *A Framework for K-12 Science Education:* **PS2.A Forces and Motion** • Objects push or pull each other when they collide or are connected. • Pushes and pulls have different strengths and directions. • Pushing or pulling on an object can change the speed or direction of its motion and can start or stop it.

Additional Supports for struggling learners:

The following supports are suggestions for this lesson and are not the only options to support students in the classroom. These supports target students that struggle with science material, this lesson or a previous lesson. These are generalized supports and do not take the place of IEP accommodations as required by each student's Individualized Education Program.

General supports for the following categories:

Reading:

1. The teacher can have students match letters prior to reading to remind them of the alphabet.
2. The teacher can have students identify words that they know in the text as the class reads.
3. The teacher should remind students to use strategies when they are reading.

Writing:

1. The teacher can provide practice for students in the area of writing both in context and practicing just letters.
2. The teacher can provide a sentence starter for the students.
3. The teacher should continually give encouragement to the students.
4. The teacher can provide constructive positive feedback during the writing process to help students understand the expectations.

Math:

1. Provide students with opportunities to interact with numbers.
2. The teacher can provide manipulatives to allow the students to count and interact with materials.

Supports for this specific lesson if needed:

Performance expectations for instruction:

1. The teacher should provide information to students in various formats to reach as many students as possible.
2. The students should be given adequate time to complete each part of the lesson.
3. The students should be allowed to express their knowledge in various formats.
4. The teacher should be sure to provide multiple ways for the students to communicate their knowledge of the material.

Engage:

1. The teacher should consider doing a demo of motion in the classroom.
2. The teacher should ask students what they see move in their every day lives.
3. The teacher can use guiding questions to have students think about playground equipment, cars and things that they play with in Physical education.

4. The teacher should have a set of clear and consistent guidelines for putting objects into motion.
5. The teacher should use intentional and flexible grouping to assign student groups.
6. The teacher should consider giving images to help students sort objects that move into categories.
7. The teacher should have clear and consistent guidelines for group work within the classroom.

Exploring:

1. The teacher should consider giving the students available materials to examine prior to designing their cars.
2. The teacher should consider giving students a template to draw their car designs.
3. Also, the teacher should explain what a blueprint is and why it is important that students make a blueprint prior to building their car.
4. The teacher should consider giving students to test their design and revise prior to the class race.

Explaining:

1. The teacher should have students view the objects again and revise their classification accordingly.
2. The students should view the "winning" car and discuss why it won the race. Then have the students revise their car design as needed.
3. The teacher should explicitly explain how to amend the blueprint of the car and provide students a different color to amend the blueprint.

Elaborating:

1. The teacher should consider asking students if they have noticed that cars go faster down hill or that riding their bike downhill is faster than going uphill.
2. The teacher should ask students to consider why things might go faster downhill.
3. The teacher might consider dropping some objects and trying to roll some objects up a "hill" in the classroom and having the students make observations.
4. The teacher should have clear and consistent guidelines for designing, building and testing object motion.
5. The teacher may need to explicitly explain what a prediction is prior to students making predictions.
6. The teacher should ask students to explain their reasoning for their prediction being right or wrong after some testing.

Evaluating:

1. The teacher should have students discuss the statements that they write in their journal.
2. The teacher should review, re-teach and enrich throughout the unit.
3. The teacher should consider having students that struggle with writing to explain their thinking after completing the statement. Also, the teacher can consider having students draw a picture to accompany their sentence. This may help students further develop their idea.