Welcome to

Module 10.0

Playing with Precision

STEM Sports® provides turnkey K-8 supplemental curriculum that uses sports as the real-life application to drive STEM-based, hands-on learning in classrooms, after-school programs, and camps.

- Content for a minimum of 16 hours of instruction that includes some healthy, physical activity.
- Turnkey kits come equipped with all of the relevant sports equipment along with the necessary science supplies.
- Each curriculum has eight lessons aligned with the Next Generation Science Standards (NGSS) and/or Common Core State Standards (CCSS) and/or National Standards for K-12 Physical Education.
- Through our 5E lesson plans, students will develop 21st-century skills such as critical thinking, collaboration, creative problem-solving, and leadership.
- Differentiation: lessons for 3rd to 5th graders and lessons for 6th to 8th grade students.
    - "Capstone" Project (6th to 8th) to commensurate student's knowledge of each curriculum.
- Assessments in each lesson to effectively evaluate students.
- Ready-to-use worksheets that align with each lesson and standards.
- Each module has a list of STEM-based, sports-related jobs pertinent to the lesson concept.
- Engineering Design Process (EDP) woven into each curriculum.
- Mindfulness Matters: important messaging to assist with the uniqueness of blending STEM with sports.
- Well designed and scalable for teachers, administrators, or volunteers.

Please visit www.STEMSports.com for additional information and to learn about the other STEM Sports® curriculum that we offer.

We sincerely hope you and your students enjoy this STEM Sports® lesson.

Mindfulness Matters

STEM sports
science • technology
engineering • math • sports

Mindfulness may not be the first thing that comes to mind when one thinks about STEM Sports®. However, mindfulness is essential to fully understanding the design and benefits of the STEM Sports® curricula by way of the following:

- Approximately 85% of STEM jobs anticipated for the year 2030 have yet to be invented.
- Moreover, within the next 10 years or so, 80% of all jobs will be STEM related.

The STEM Sports® curricula distinctly blends STEM content areas through hands-on/active play and sports. Active play provides a mechanism to teach STEM concepts; therefore, learning is integrated, engaging and meaningful, as participants are exposed to STEM applications through real world experiences.

Teachers of the curricula should be mindful of the fact STEM Sports® curricula are:

- Collaborative in nature, ensuring peer-to-peer learning opportunities
- Inquiry-based, allowing learners to discover information for themselves
- Designed for problem-solving, an essential lifelong skill
- Hands-on, engaging all types of learners
- Student-led, encouraging ownership of learning
- Active, promoting physical activity and wellbeing

Participants of the curricula should be mindful of the fact STEM Sports® curricula are:

- Introductory to STEM concepts: facilitates comfort with STEM content areas
- Blends play and sport: an environment that is engaging, fun, and applicable to life outside the classroom
- Designed for all: ensuring success for all participants – you don't have to be athletic or excel at science to accomplish curricula tasks
- Applicable to the real world: learning is meaningful for all participants

In sum, stakeholders should be mindful of all the STEM Sports® curricula have to offer. The unique design of the STEM Sports® curricula is essential to maximize learning and the understanding of STEM concepts in sports and life applications.

Module 10.0

GRADES 3-5

Playing with Precision

Concept

Energy Transfer

Objective

Students will be able to design a chain reaction system that transfers energy from the ball in three ways by using the Engineering Design Process.

Standards

Next Generation Science Standards (NGSS) Connections

4-PS3-1. Use evidence to construct an explanation relating the speed of an object to the energy of that object.

4-PS3-4. Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.

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Materials Needed

Paper, Cups and Pencils

Sequence of Lesson

Engage: Have students use small paper balls and a cup to try to make a "basket" with one bounce. Ask students to describe what is happening to the energy in the ball when it bounces. Share out with the partners or groups using instructional strategies.

Explore: Line up buckets and line up students ten feet from the baskets. Have students try to make the ball in the basket by creating a chain reaction using rolls, bounces, a second ball or other common classroom objects (chair, ramp, etc). Students can angle the basket in different directions, but it must stay ten feet away (Give students about 5-10 minutes.).

Explain: The instructor should explain how energy can be transferred from one object to another (i.e. Electric to motion (cars), heat to motion (wind), potential to kinetic). Explain to students the difference between kinetic and potential energy, as well as how mass to the height of the object can influence its energy.

Elaborate: Have students brainstorm several ways to complete a chain reaction with the materials provided. They should each draw out three diagrams with labels. In groups, they should evaluate the designs and select two designs to build and test. Allow students time to construct and test two designs as a group.

Evaluate: Students should use their most successful* design. Have students draw and label where the energy transfers are taking place, and if more or less energy is transferred.

Extend: Have students go back and redesign their most successful design. Students should justify their design changes in writing.

STEM Jobs in Sports

- Arena Mechanical Engineer
- Materials Scientist
- Kinesiotherapist
- Stadium Architect
- Exercise Physiologist

Module 10.0

Name: _____

Playing with Precision

GRADES 3-5

Elaborate: Brainstorm and Draw Three Diagrams with Labels

Evaluate: Select Two Designs & Test

	Shot 1	Shot 2	Shot 3	Shot 4	Shot 5
Design 1					
Design 2					

MADE SHOTS = O
MISSED SHOTS = X

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Name: _____

Playing with Precision

GRADES 3-5

Evaluate: Draw and Label Energy Transfers

Module 10.0

GRADES 6-8

Playing with Precision

Concept

Accuracy and Precision

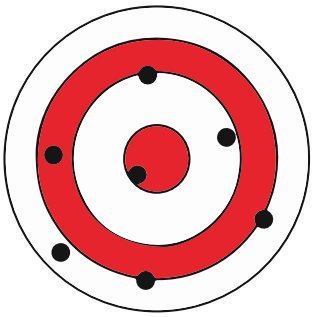
Objective

Students will measure accuracy and precision by determining percent success and percent error. Students will explain how the amount of force put on the ball will influence the distance traveled by completing a force diagram.

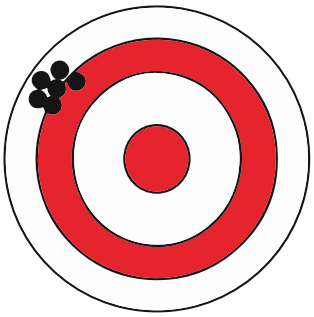
Standards

Next Generation Science Standards (NGSS) Connections

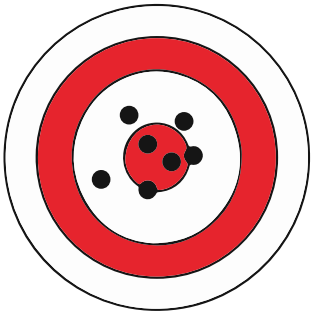
MS-PS2-2. Plan an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object.
Understanding about the Nature of Science: Scientific Knowledge is Based on Empirical Evidence.



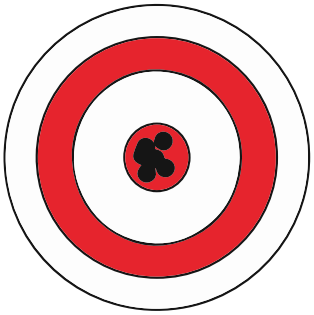
Low accuracy
Low precision



Low accuracy
High precision



High accuracy
Low precision



High accuracy
High precision

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Materials Needed

Paper, Cups and Pencils

Sequence of Lesson

Engage: In the classroom, have students use small paper balls and a cup to try to make a "basket". Ask students to describe how they would measure their success. Share out with the class using instructional strategies.

Explore: Line up buckets and line up students ten feet from the baskets. Have students try to make as many baskets as possible in a 2 minute time frame. Students should record data in the provided data table.

Explain: The instructor should explain the differences and similarities between precision and accuracy. Discuss statistical measures of accuracy (percent error or percent success) and precision (range).

Elaborate: Have students brainstorm ways to measure range during the experiment. Alternatively, provide them with the following instructions: Have a second student stand at the bucket end of the set up and mark with chalk where the ball hits each time it misses. Then students will measure each miss distance and find the average miss difference (include shots made with a value of 0) or they can find a simple range. Then have students perform the experiment again; collect data on 20 shots. They should also calculate percent success by dividing the number of made shots by the total number of shots and multiply by 100. Repeat 3 - 5 times.

Evaluate: Students should create a Venn diagram that outlines the differences between accuracy and precision.

Extend: Repeat the experiment a third time. This time students should vary the force (strength) acting on the ball every time (independent variable) and then calculate percent success and range/average miss distance for each varying force tested. Repeat each force 3 - 5 times. Force suggestions (easy toss, normal toss, hard toss).

STEM Jobs in Sports

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- Exercise Physiologist

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Playing with Precision

GRADES 6-8

Explore: Number of Shots Made In 2 Minutes

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

MADE SHOTS = O
MISSED SHOTS = X

Elaborate: Calculate "Success" Percentage

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

MADE SHOTS = O
MISSED SHOTS = X

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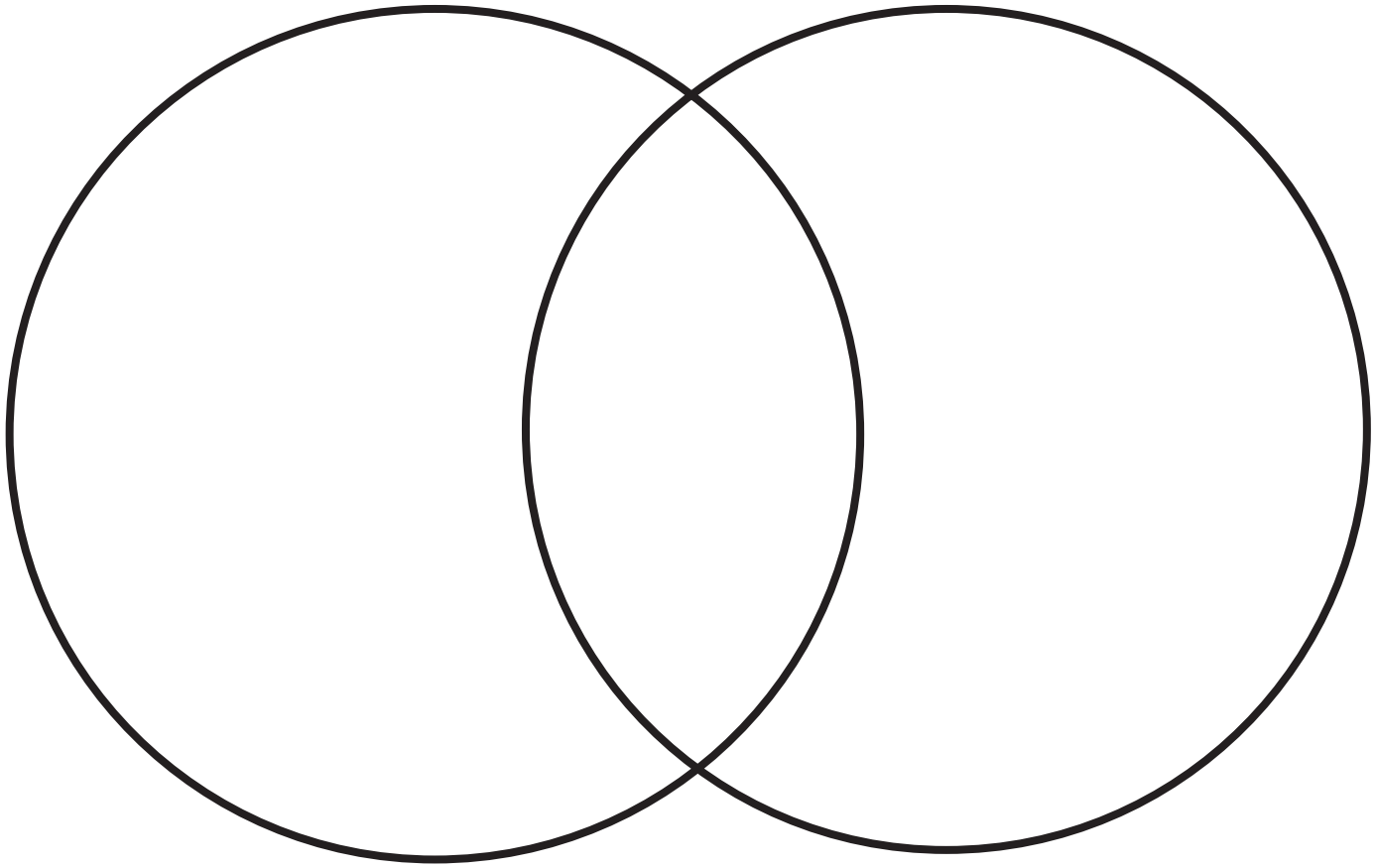
Name: _____

Playing with Precision

GRADES 6-8

Evaluate: Accuracy and Precision



Notes