STEM.ORG ACCREDITED
EDUCATIONAL EXPERIENCE

STEM sports®

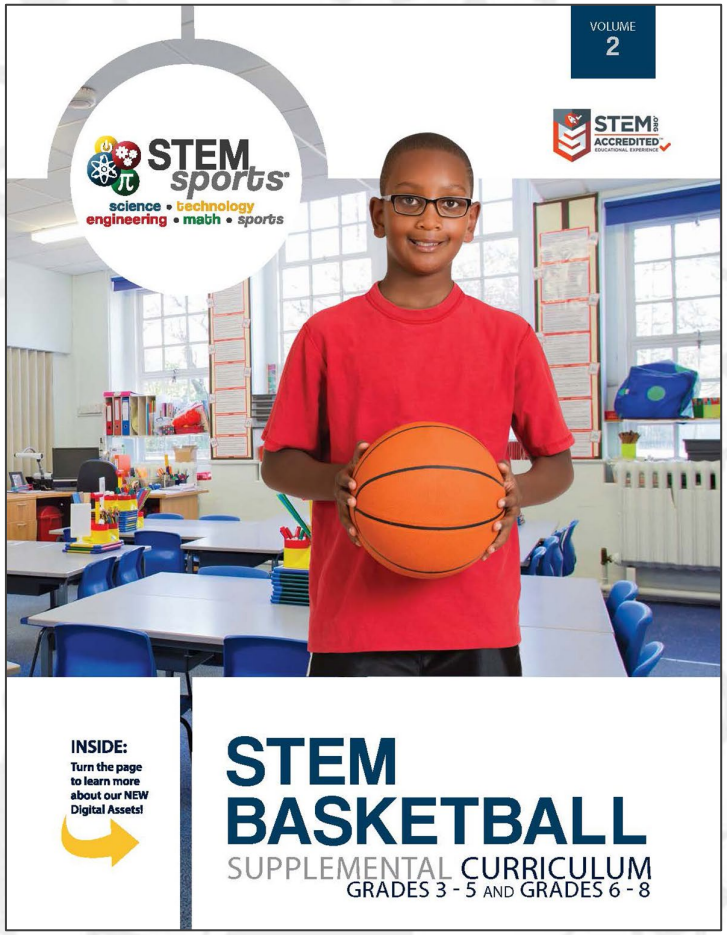
science • technology
engineering • math • sports

4 QUALITY EDUCATION

advancing
health
equity

etr.

About STEM Sports®



STEM Sports® provides turnkey K-8 supplemental curricula that uses sports as the real-life application to drive STEM-based learning in classrooms, after-school programs and camps in the United States as well as in international markets.

About STEM Sports®

- Began in 2016 after a successful launch of STEM BMX for USA BMX
- STEM Volleyball and STEM Basketball followed
- STEM Soccer, STEM Football, and STEM Multi-Sport launched in 2017
- In August 2018, STEM Sports® received the service mark/trademark/supplemental register from the United States Patent and Trademark Office
- To begin 2019, STEM Sports® and Skyhawks Sports Academy, LLC began an exclusive licensing agreement whereby Skyhawks' STEM Sports® camps and programs are offered
- STEM Sports® curriculum is in schools, after-schools or camp programs in 49 U.S. states
- STEM Sports® curriculum is being piloted in Japan, Australia, Ecuador, Egypt, Saudi Arabia and other countries are to follow
- Summer 2020 saw the release and introduction of STEM Multi-Sport for K-2 and STEM Golf
- STEM Hockey, STEM Lacrosse, STEM Tennis, as well as STEM Baseball and STEM Softball will be introduced in 2021

Time

Module 1.1

GRADES 3-5

Basketball Measurements

Concept
Math: Area and Perimeter

Objective
Students will measure the area and perimeter of a polygon by using a square tile and a tape measure (not a ruler). Students will calculate the perimeter and area of a polygon by using a formula and dimension (either measured or given).

Time
(1) 60-minute session

Standards

Common Core State Standards Connections

CCSS.MATH.CONTENT.3.MD.C.6
Measure areas by counting unit squares (square cm, square m, square in, square ft, and improvised units).

CCSS.MATH.CONTENT.3.MD.C.7.A
Find the area of a rectangle with whole-number side lengths by tiling it, and show that the area is the same as would be found by multiplying the side lengths.

CCSS.MATH.CONTENT.3.MD.D.8
Solve real world and mathematical problems involving perimeters of polygons, including finding the perimeter given the side lengths, finding an unknown side length, and exhibiting rectangles with the same perimeter and different areas or with the same area and different perimeters.

CCSS.MATH.CONTENT.4.MD.A.3
Apply the area and perimeter formulas for rectangles in real world and mathematical problems. For example, find the width of a rectangular room given the area of the flooring and the length, by viewing the area formula as a multiplication equation with an unknown factor.

National Standards for K - 12 Physical Education

Standard 4: The physically literate individual exhibits responsible personal and social behavior that respects self and others.

Each STEM Sports® teacher's manual contain eight (8) robust supplemental curriculum lessons or modules that provide a minimum of 16 hours of learning time.

Within each module, the time needed is clearly indicated.

Standards

Each curriculum has eight lessons aligned with either the Next Generation Science Standards (NGSS) and/or Common Core State Standards (CCSS) and/or National Standards for K–12 Physical Education.

Module 8.1

GRADES 3-5

Properties of a Football and Foam Football

Concept
Science: Properties of Matter

Objective
Students will divide a football into equal areas by using a diagram. Students will explain how the properties of a football, including shape, affect the football's behavior

Time
(1) 90-minute session

Standards

Common Core State Standards Connections

CCSS.MATH.CONTENT.3.G.A.2
Partition shapes into parts with equal areas. Express the area of each part as a unit fraction of the whole. *For example, partition a shape into 4 parts with equal area, and describe the area of each part as 1/4 of the area of the shape.*

Next Generation Science Standards Connections

5-PS1-3. Make observations and measurements to identify materials based on their properties. Background: The shape of a football is a "prolate spheroid," which is unique as it allows the object to spin in a spiral motion when thrown properly. The shape of a football also lends itself to some irregular bounces when it hits the ground. The first footballs were shaped after a pig's inflated bladder. Footballs, however, have continued to be shaped in prolate spheroids, which have made them easier to carry and throw.

The developers of EA Sports' video game Madden NFL have spent hours in offices, hallways, and even outside on lawns, dropping, bouncing and rolling footballs to record the results. If you throw a spherical object in the air, you can surmise where it's going to go. However, if you throw a football in the air and it lands on the ground, there is no telling how many ways it can go.

National Standards for K - 12 Physical Education

Standard 1: The physically literate individual demonstrates competency in a variety of motor skills and movement patterns.

Standard 4: The physically literate individual exhibits responsible personal and social behavior that respects self and others.

Supplies Provided
Worksheets, Footballs, Foam Footballs, Scale and Tape Measures

Please email Info@STEMSports.com to access Worksheet Keys.

Materials Needed
Pencils

Supplies

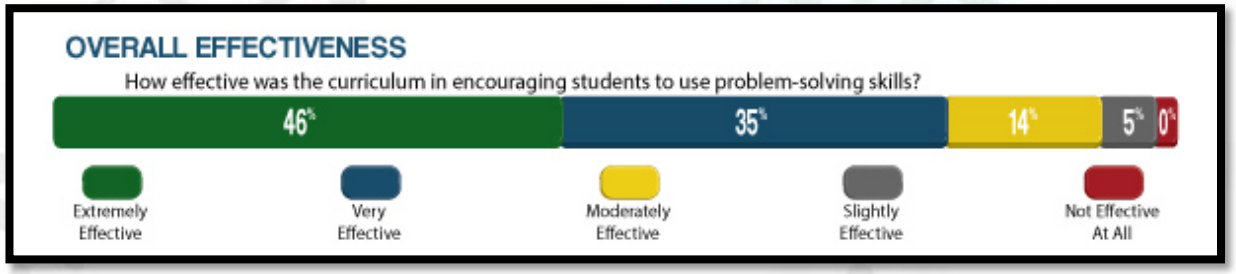
STEM Sports® provides our Supplemental Curriculum Teacher's Manuals:

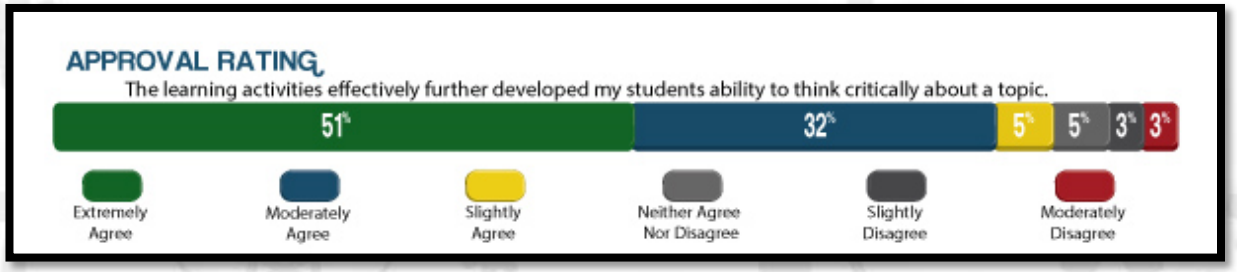
- In a turnkey kit supplied with all of the sports and science equipment necessary to execute the program
- In a turnkey kit supplied with just the science equipment necessary to execute the program (no athletic balls)
- As a stand-alone product thus just the manual

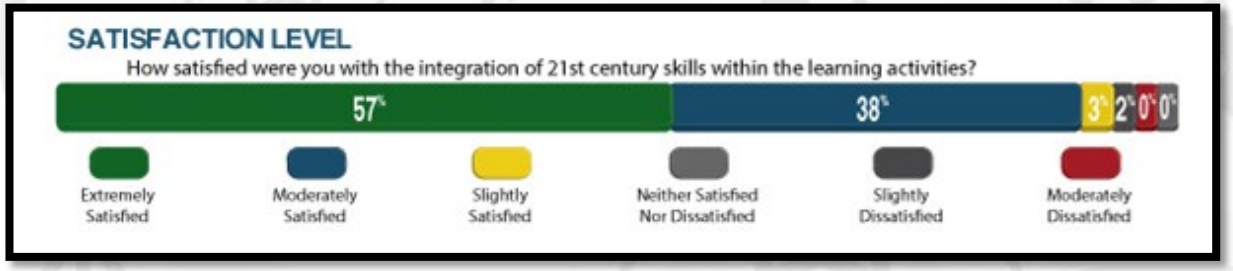
Results

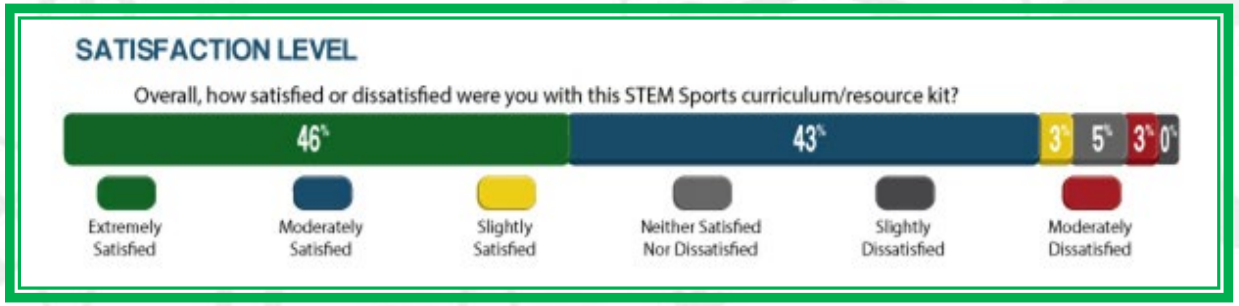
Students will develop 21st-century skills such as critical thinking, collaboration, creative problem-solving, and leadership.

STEM Sports® curriculum survey results were accumulated from January 25, 2019 through December 23, 2019 and are comprised from 37 individual teachers/administers across the United States*.



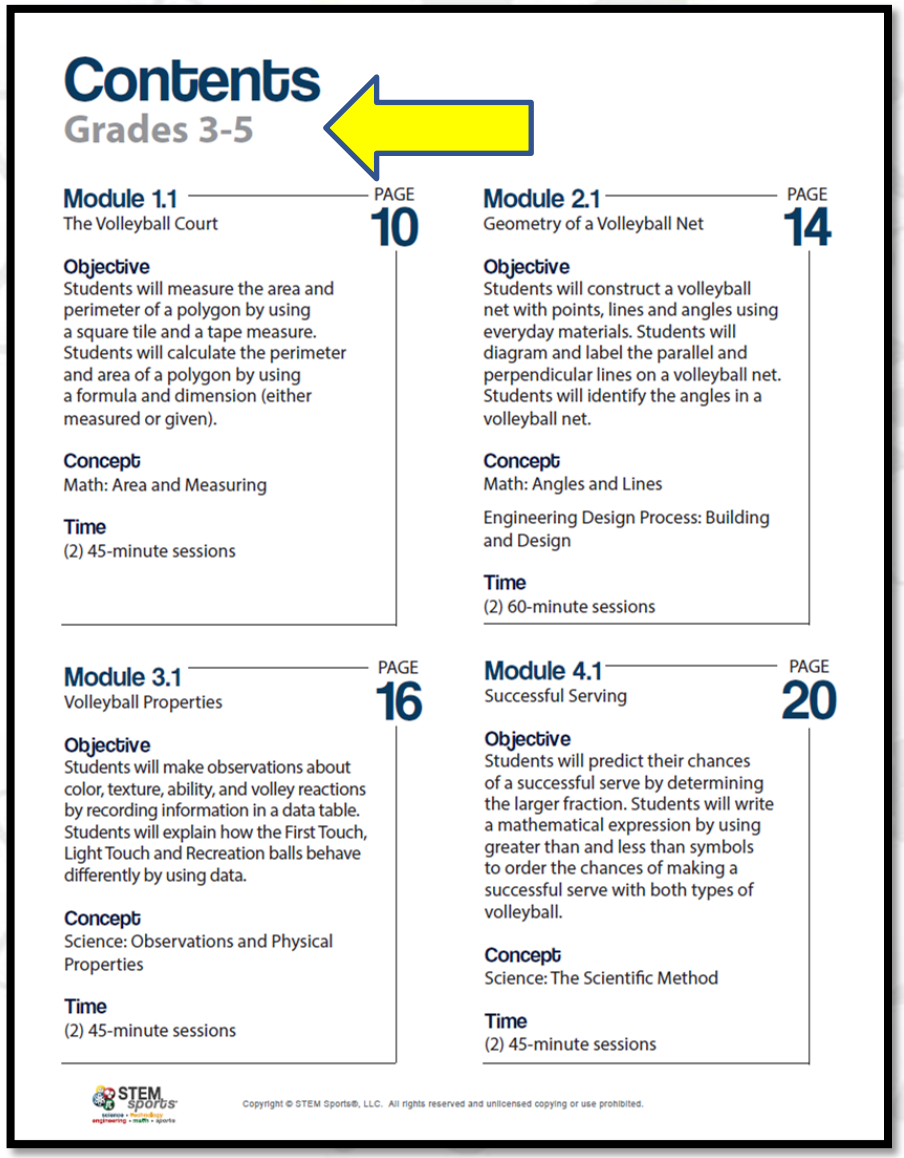




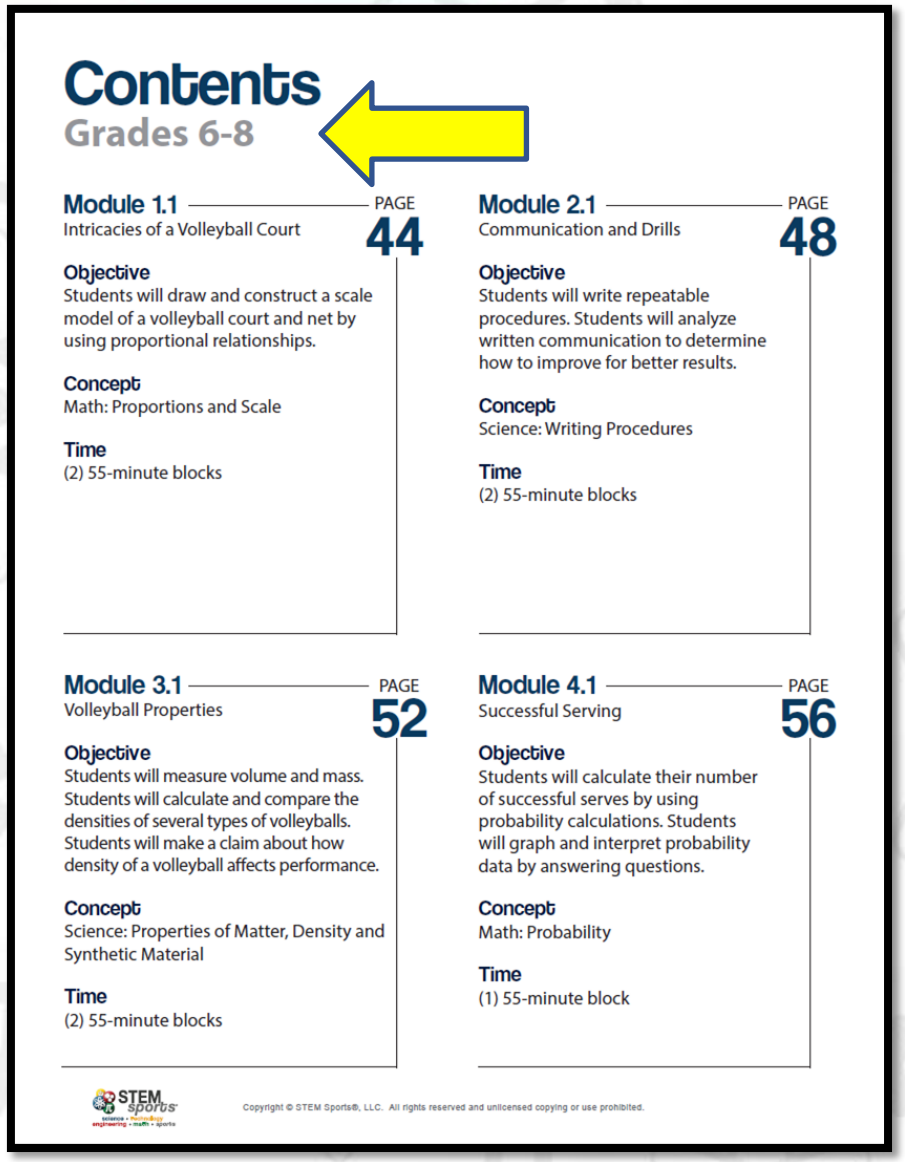


*Results are based on Volume 1; Volume 2 available as of 5/1/20

Grades – Who is this for?



Contents
Grades 3-5



Contents
Grades 6-8

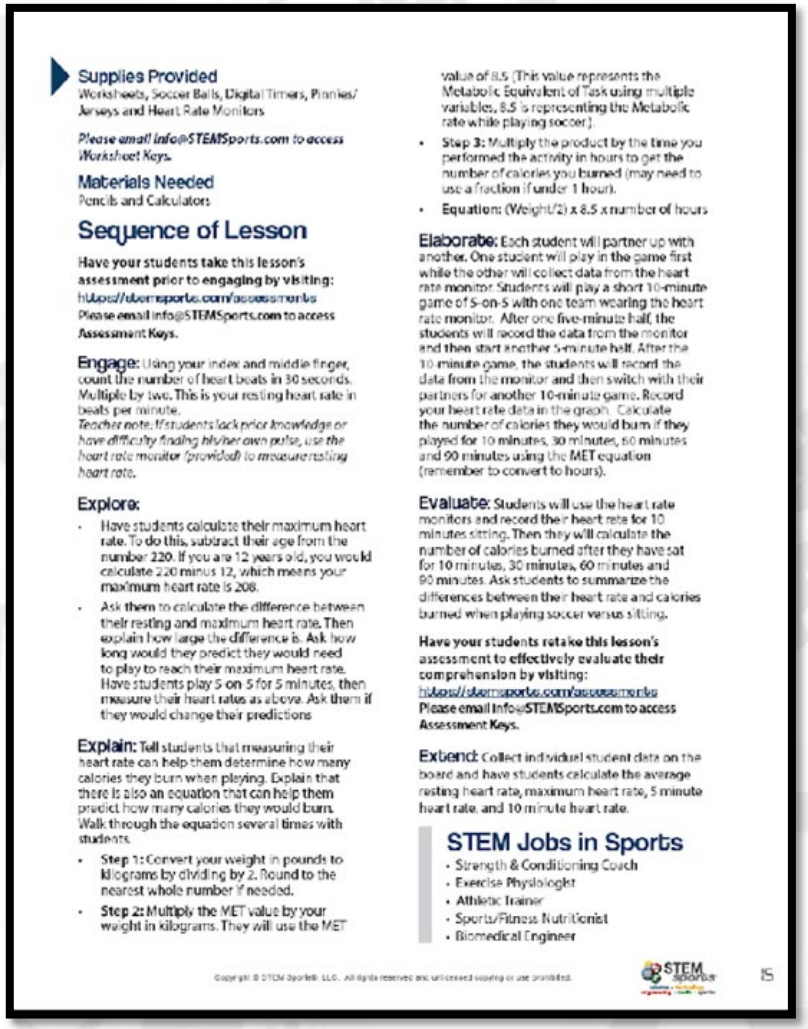
Each teacher manual has 3rd to 5th grade lessons and lessons for 6th to 8th grade students.

“Capstone” Project (for 6th to 8th grade students) to commensurate student’s knowledge of each curriculum.

Who teaches the curriculum?

Using the gold standard for science curriculum, the 5E instructional model is used in every module: Engage, Explore, Explain, Elaborate and Evaluate. STEM Sports® has even added a sixth sequence: Extend.
This sequence of lesson methodology abides by science and STEM teacher's instructional procedures which also creates great ease for generalist teachers, PE teachers, sports coaches, and volunteers. In fact, training or professional development is not a prerequisite to teach our lessons.

Even students for whom the curriculum is designed for can lead the modules for their fellow students. After all, STEM skills are all about Leadership, Problem Solving, Critical Thinking and Collaboration.



Supplies Provided
Worksheets, Soccer Balls, Digital Timers, Pinnies/ Jerseys and Heart Rate Monitors

Please email info@STEMSports.com to access Worksheet Keys.

Materials Needed
Pencils and Calculators

Sequence of Lesson

Have your students take this lesson's assessment prior to engaging by visiting:
https://stemsports.com/assessments
Please email info@STEMSports.com to access Assessment Keys.

Engage: Using your index and middle finger, count the number of heart beats in 30 seconds. Multiple by two. This is your resting heart rate in beats per minute.
Teacher note: If students lack prior knowledge or have difficulty finding his/her own pulse, use the heart rate monitor (provided) to measure resting heart rate.

Explore:

- Have students calculate their maximum heart rate. To do this, subtract their age from the number 220. If you are 12 years old, you would calculate 220 minus 12, which means your maximum heart rate is 208.
- Ask them to calculate the difference between their resting and maximum heart rate. Then explain how large the difference is. Ask how long would they predict they would need to play to reach their maximum heart rate. Have students play 5 on 5 for 5 minutes, then measure their heart rates as above. Ask them if they would change their predictions

Explain: Tell students that measuring their heart rate can help them determine how many calories they burn when playing. Explain that there is also an equation that can help them predict how many calories they would burn. Walk through the equation several times with students.

- **Step 1:** Convert your weight in pounds to kilograms by dividing by 2. Round to the nearest whole number if needed.
- **Step 2:** Multiply the MET value by your weight in kilograms. They will use the MET value of 8.5 (This value represents the Metabolic Equivalent of Task using multiple variables, 8.5 is representing the Metabolic rate while playing soccer.)
- **Step 3:** Multiply the product by the time you performed the activity in hours to get the number of calories you burned (may need to use a fraction if under 1 hour).
- **Equation:** (Weight/2) x 8.5 x number of hours

Elaborate: Each student will partner up with another. One student will play in the game first while the other will collect data from the heart rate monitor. Students will play a short 10-minute game of 5-on-5 with one team wearing the heart rate monitor. After one five-minute half, the students will record the data from the monitor and then start another 5-minute half. After the 10-minute game, the students will record the data from the monitor and then switch with their partners for another 10-minute game. Record your heart rate data in the graph. Calculate the number of calories they would burn if they played for 10 minutes, 30 minutes, 60 minutes and 90 minutes using the MET equation (remember to convert to hours).

Evaluate: Students will use the heart rate monitors and record their heart rate for 10 minutes sitting. Then they will calculate the number of calories burned after they have sat for 10 minutes, 30 minutes, 60 minutes and 90 minutes. Ask students to summarize the differences between their heart rate and calories burned when playing soccer versus sitting.

Have your students retake this lesson's assessment to effectively evaluate their comprehension by visiting:
https://stemsports.com/assessments
Please email info@STEMSports.com to access Assessment Keys.

Extend: Collect individual student data on the board and have students calculate the average resting heart rate, maximum heart rate, 5 minute heart rate, and 10 minute heart rate.

STEM Jobs in Sports

- Strength & Conditioning Coach
- Exercise Physiologist
- Athletic Trainer
- Sports/Fitness Nutritionist
- Biomedical Engineer

Virtual & Distance Learning

Now more than ever, educators are seeking curricula that is scalable and flexible to administer virtually if or when students are not present in school classrooms. The 5E instructional model supports inquiry-based and active learning which allows student to make their own discoveries and to process and absorb STEM skills without the needs of a lecture.

This equates to teaching our curriculum **virtually or at home** a lessons and modules are delivered with ease on platforms such as Zoom, Google Classroom, or Microsoft Team.

Jobs

As a STEM education company, we realize the importance and purpose of STEM academia: to help young students obtain important science, technology, engineering and math skills so that when they join the workforce, they are ready and prepared. Moreover, by offering these important STEM skills, students can also see career paths at an earlier age so that their education is geared for their long-term success.

In each module, a list of STEM jobs within or touching the sports industry are offered. This enables teachers and curriculum administers the opportunity to have robust classroom discussions about jobs that some students have yet to realize.

Not every student's dream of becoming a professional athlete will be realized but there is still a place for them to work within the sports industry.

Supplies Provided
Worksheets and Basketballs

Please email Info@STEMSports.com to access Worksheet Keys.

Materials Needed
Labels of Multiple Foods, Calculators and Pencils

Sequence of Lesson

Have your students take this lesson's assessment prior to engaging by visiting: https//stemsports.com/assessments
Please email Info@STEMSports.com to access Assessment Key.

Engage: Ask students to consider: Why do they get hungry faster than normal after they play sports for a long time?

Explore: Have students look at the labels of multiple after-sports foods and drinks, such as coconut water, granola bars, etc. Tell them that kids burn about 200 calories per hour playing basketball. Have them calculate how many coconut waters they need to drink if they play for two hours.

Explain: Explain how the body burns calories by using sugar to make energy. We need our energy in to equal our equal out. Explain that we use energy all the time to keep our bodies warm and breathe, but when we are playing sports like basketball, we are burning more energy. Explain that we can calculate how much energy we burn using multiplication and division. For younger students, walk through the steps with them for LeBron James (he weighs 250 pounds) playing for 30 minutes . Ask students if they can predict if they will use more or less energy than LeBron James to play basketball.

- **Step 1:** Convert your weight in pounds to kilograms by dividing by 2. Round to the nearest whole number if needed.
- **Step 2:** Multiply the MET value by your weight in kilograms. They will use the MET value of 7.0.
- **Step 3:** Multiply the product by the time you performed the activity in hours to get the number of calories you burned. (May need to use a fraction if under 1 hour).
- **Equation:** (Weight/2) x 7 x Number of hours.

Elaborate: Have students play for 15 minutes. They will then calculate the calories they burned during the time they played basketball. Using the worksheet, have students complete the calculation.

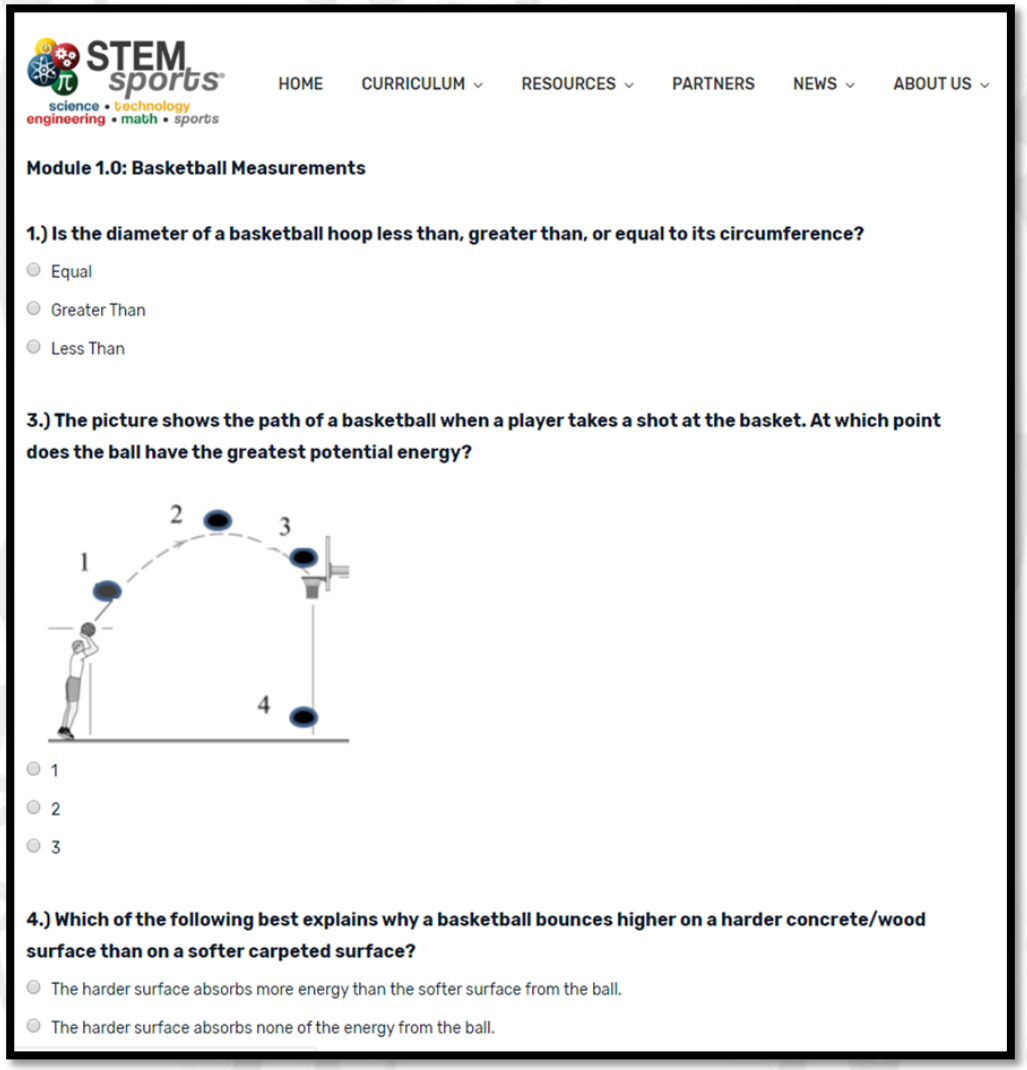
Evaluate: Ask students to predict how much they will burn if they play for 30 minutes, 1 hour?
Have your students retake this lesson's assessment to effectively evaluate their comprehension by visiting: https//stemsports.com/assessments
Please email Info@STEMSports.com to access Assessment Key.

Extend: Students can work backwards and calculate how long it would take to burn 450 calories.

STEM Jobs in Sports

- Team Doctor
- Nutritionist
- Athletic Trainer
- Dietitian
- Strength and Conditioning Coach

Assessments



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HOME CURRICULUM RESOURCES PARTNERS NEWS ABOUT US

Module 1.0: Basketball Measurements

1.) Is the diameter of a basketball hoop less than, greater than, or equal to its circumference?

- Equal
- Greater Than
- Less Than

3.) The picture shows the path of a basketball when a player takes a shot at the basket. At which point does the ball have the greatest potential energy?

- 1
- 2
- 3

4.) Which of the following best explains why a basketball bounces higher on a harder concrete/wood surface than on a softer carpeted surface?

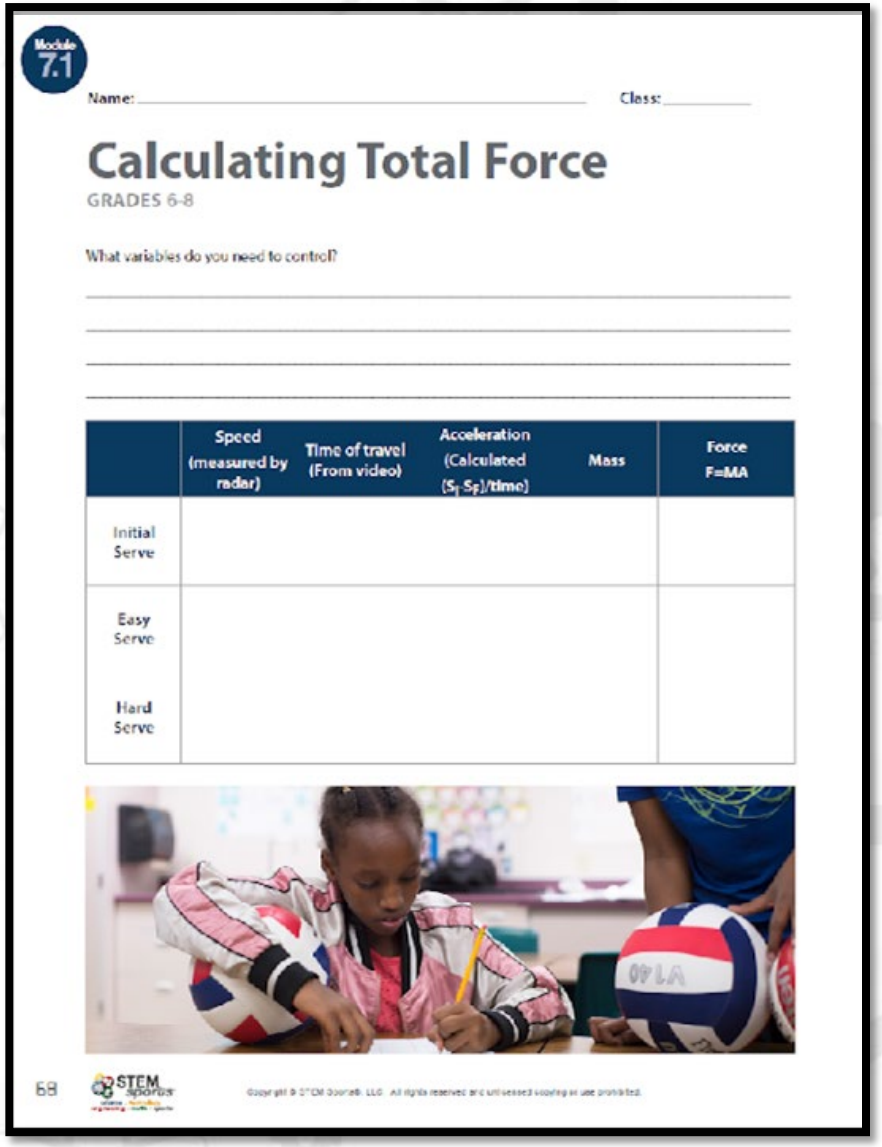
- The harder surface absorbs more energy than the softer surface from the ball.
- The harder surface absorbs none of the energy from the ball.

Each curriculum and every module has a corresponding student assessment. As part of the sequence of the lesson, students are to take the assessment before and after the lesson to better evaluate their comprehension level.

Teachers/administers will receive instant results once the digital assessment is completed.

Worksheets

Ready-to-use worksheets are utilized in almost every lesson of every module. These worksheets are provided within the teacher manual and are designed for open-ended responses as well as for rigorous data collection. Furthermore, they assist in evaluating the student's comprehension level of the standardized lessons.



Module 7.1

Name: _____ Class: _____

Calculating Total Force

GRADES 6-8

What variables do you need to control?

_____

_____

_____

_____

	Speed (measured by radar)	Time of travel (From video)	Acceleration (Calculated (S_f-S_i)/time)	Mass	Force F=MA
Initial Serve					
Easy Serve					
Hard Serve					

Engineering Design Process (EDP)

Supplies Provided
Worksheets, Soccer Balls, String, Tape, Bells and Tent Pegs

Please email Info@STEMSports.com to access Worksheet Keys.

Materials Needed
Pencils

Sequence of Lesson

Have your students take this lesson's assessment prior to engaging by visiting: https://stemsports.com/assessments
Please email Info@STEMSports.com to access Assessment Keys.

Engage: Play the few seconds of first video under Goal-Line Technology at www.STEMSports.com by clicking "Resources", then "STEM Soccer". Ask students if a goal would be given here or not. Have students discuss with their groups. Ask them if they think it is fair to use technology to determine if it was a goal. Why or why not? Show them the rest of the video.

Explore: Play the second video under Goal-Line Technology at www.STEMSports.com by clicking "Resources", then STEM Soccer. Ask students to draw a diagram of the current technology at the World Cup.

Explain: Tell students that technology can be designed using the Engineering Design Process. Discuss Engineering Design Process steps.

Engineering Design Process

Explain that sometimes we need to engineer a simpler product for different uses. For example, we may not use the system developed for the World Cup in a youth community league, but it still might be fair if the youth league had a device to determine if the entire ball crosses the line. Their problem is that the current technology is too expensive.

Elaborate: Students need to design a low tech version of goal-line technology. Students will brainstorm, prototype, and test the prototype. Use the engineering design sheet to help guide them through the process.

Evaluate: Students should present their designs to the class with evidence to support that it is successful.

Have your students retake this lesson's assessment to effectively evaluate their comprehension by visiting: https://stemsports.com/assessments
Please email Info@STEMSports.com to access Assessment Keys.

Extend: If you have other materials available, allow students to have an open design challenge. Students need to use data to redesign and justify their design changes in writing.

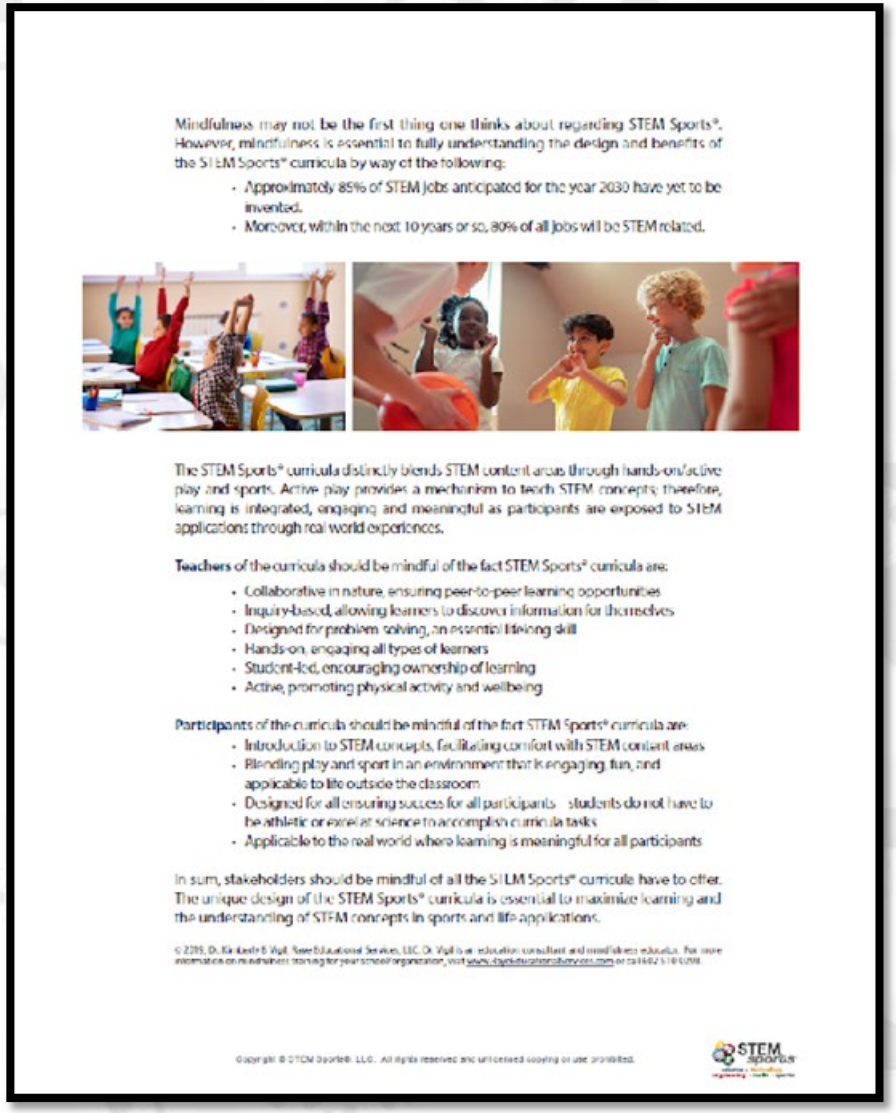
STEM Jobs in Sports
- Computer/Application Coder (App)
- Video Producer
- Patent Agent
- Computer Engineer
- Stadium/Arena: Quality Control Coordinator

Fun Facts
Perhaps one of the most famous goal-line related incidents came in 2010 in the knockout stages of the FIFA World Cup with Germany and England. Just before halftime, Frank Lampard of England shot the ball and it hit the underside of the crossbar, resulting in the ball fully crossing the goal line but bouncing back into the field of play due to backspin. Neither the referee nor his assistant could award the goal. England went on to lose to Germany in that game 4-1.

The Engineering Design Process (EDP) is a key element of any STEM curriculum and is woven into each STEM Sports® supplemental curriculum.

Mindfulness

The mental health of both teachers and students alike should not be overlooked during any aspect of the education process. STEM Sports® recognizes this and establishes that mindfulness matters when tackling our curriculum. The need and importance of the double play of STEM & Sports is established at the beginning of each curriculum.



Mindfulness may not be the first thing one thinks about regarding 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:

- Introduction to STEM concepts, facilitating comfort with STEM content areas
- Blending play and sport in an environment that is engaging, fun, and applicable to life outside the classroom
- Designed for all ensuring success for all participants - students do not have to be athletic or excel at science to accomplish curricula tasks
- Applicable to the real world where 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.

STEM Basketball – Grades 3-5

Module 1.1
The Measurements of Basketball

Objective
Students will measure the area and perimeter of a polygon by using a square tile and a tape measure. Students will calculate the perimeter and area of a polygon by using a formula and dimension (either measured or given).

Concept
Math: Area and Perimeter

Time
(1) 60-minute session

Module 2.1
Forces in Basketball

Objective
Students will conduct a controlled experiment to determine the change in motion by measuring the number of bounces and the height of the first bounce. Students will predict how gravity/motion will affect/change the ball if it is dropped at a higher or lower height.

Concept
Science: Motion and Gravity

Time
(2) 45-minute sessions

Module 3.1
Understanding Basketball

Objective
Students will explain why balls behave differently by using observations about the solids and gases that make up the balls. Students will make observations about texture, ability to stretch, and state of matter of materials by recording information in a data table. Students will explain there is air inside the ball by comparing an empty ball and a full ball.

Concept
Science: States of Matter, Observations

Time
(2) 45-minute sessions

Module 4.1
Motion and Basketballs

Objective
Students will round whole numbers from the tenth place. Students will divide two whole numbers to determine the speed of a basketball. Students will explain speed as a division problem between distance and time.

Concept
Science: Measuring Speed
Math: Division and Real World Problems

Time
(2) 45-minute sessions

STEM Basketball – Grades 3-5

Module 5.1
Engineering Design Challenge

Objective
Students will design a device that increases the motion of an object by conducting a controlled test. Students will conduct a controlled test on their design by taking measurements and recording observations.

Concept
Motion and Engineering for Accuracy

Time
(2) 45-minute sessions

Module 6.1
Calculating Calories

Objective
Students will calculate calories burned during gameplay by using multiplication and division. Students will predict the calories they will burn by doubling numbers.

Concept
Math: Multiplication and Division

Time
(1) 60-minute session

Module 7.2
Shot Tracking

Objective
Students will compare fractions based on their free throw accuracy by using the greater than and less than symbols.

Concept
Math: Fractions

Time
(1) 60-minute session

Module 8.1
Advancements in Shoe Technology

Objective
Students will make detailed observations by using their senses and measurements to make inferences about changes in technology.

Concept
Science: Observation

Time
(2) 45-minute sessions

STEM Basketball – Grades 6-8

Module 1.1
Basketball Measurements

Objective
Students will use actual data to determine the scale sizes of a basketball court by using proportional relationships.

Concept
Math: Propositions

Time
(2) 50-minute blocks

Module 2.1
Science of Basketball

Objective
Students will compare the forces acting and reacting on a basketball by using data from a controlled experiment. Students will explain how Newton's Third Law is demonstrated in dribbling a basketball.

Concept
Science: Physics

Time
(3) 50-minute blocks

Module 3.1
Understanding Basketball

Objective
Students will describe how temperature changes the properties of the basketball by drawing a diagram of the molecular motion inside the ball. Students will describe how temperature changes the properties of the basketball by drawing a diagram of the molecular motion of the solid ball material.

Concept
Science: Molecules and Heat

Time
(2) 50-minute blocks

Module 4.1
Velocity and Acceleration

Objective
Students will calculate the force used on a basketball in different pass types by using Newton's Second Law. Students will describe the materials of a basketball by using the physical and chemical properties.

Concept
Science: Physics and Chemistry

Time
(2) 50-minute blocks

STEM Basketball – Grades 6-8

Module 5.1
Engineering Design Challenge

Objective
Students will design and build a mechanical shooting device (aka catapult) by using the Engineering Design Process. Students will test and redesign their prototype by using Newton's Second Law to determine the change in force.

Concept
Engineering and Science: Physics

Time
(3) 50-minute blocks

Module 6.1
Calculating Calories

Objective
Students will explain how food is converted to energy (kcal) through cellular respiration. Students will develop an equation for calories burned during activity by using letters to represent variable for the equation.

Concept
Science and Math: Biology and Equations

Time
(1) 50-minute block

Module 7.2
Shot Tracking with Technology

Objective
Students will use data collected to make a claim using evidence from technology by interpreting graphs.

Concept
Science and Math: Process of Science, Statistics

Time
(2) 50-minute blocks

Module 8.1
Advancements in Shoe Technology

Objective
Students will use qualitative data to evaluate and improve shoe technology by using the Engineering Design Process.

Concept
Engineering

Time
(2) 50-minute blocks

STEM Basketball Products

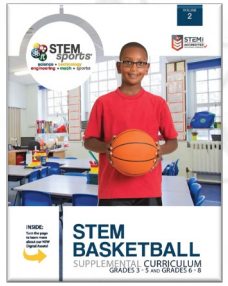
Full Kit

- Multiples of 18 different products in the kit
- Long shelf-lives
- Features: 10 basketballs and five hair dryers

Non-Sports Kit

- Without 10 basketballs, pump, inflation needles and ball bags.

Manual Only



STEM Football – Grades 3-5

Module 1.1
Measuring and Comparing

Objective
Students will measure the length of a throw using multiple units of measure. Students will compare length using greater than or less than signs.

Concept
Math: Measurement

Time
(1) 55-minute session

Module 2.1
Technological Advancements and Improved Quarterback Play

Objective
Students will collect data and display it in a bar graph. Students will use a bar graph to make a claim about the effectiveness of receiver gloves.

Concept
Math: Graphs

Time
(1) 55-minute session

Module 3.1
The Advancement of In-Game Communication

Objective
Students will define a problem that needs to be solved using the Engineering Design Process. Students will present their design ideas to the class.

Concept
Engineering Designing and Communicating

Time
(1) 75-minute session

Module 4.1
The Evolution of a Football Helmet

Objective
Students will describe how damage to the brain can influence the senses. Students will describe how helmet technology can help protect players from damage to the brain.

Concept
Science: Senses and the Brain

Time
(1) 75-minute session

STEM Football – Grades 3-5

Module 5.1
Measuring Football Distances

Objective
Students will calculate the number of inches in an X yard or plays with varying yardage using an equation. Students will use the order of operations to calculate the total number of inches, centimeters, or millimeters in number of yards.

Concept
Math: Order of Operations

Time
(1) 90-minute session

Module 6.1
Extra Point vs Two-Point Conversion Success

Objective
Students will predict the outcome of a two-point conversion and extra point try by determining the arger fraction. Students will write the chances of an extra point over a two-point conversion in a mathematical expression by using a greater than less than symbol.

Concept
Math: Fractions and Mathematical Expressions

Time
(1) 55-minute session

Module 7.1
Intricacies of a Football Field

Objective
Students will calculate the area of a football field by using multiple units (in2 and yd2). Students will construct and test a model using math. Students will calculate the area of the football traveled over to make a field goal by counting units on a quadrant plane system.

Concept
Math: Units and Area

Time
(3) 55-minute sessions

Module 8.1
Properties of a Football and Foam Football

Objective
Students will divide a football into equal areas by using a diagram. Students will explain how the properties of a football including shape, affect the football's behavior.

Concept
Science: Properties of Matter

Time
(1) 90-minute session

STEM Football – Grades 6-8

Module 1.1
Arm Strength: Youth vs Foam Footbal

Objective
Students will collect and graph data of a controlled experiment by using a line graph. Students will explain the relationship between kinetic energy, mass and speed by writing a claim evidence, reasoning paragraph based on class data.

Concept
Science: Energy and Motion

Time
(2) 55-minute blocks

Module 2.1
Technological Advancements and Improved Quarterback Play

Objective
Students will calculate their number of passes they could complete in a season by using probability calculations. Students will graph and interpret probability data by using technology and answering questions.

Concept
Math: Graphs and Probability

Time
(2) 55-minute blocks

Module 3.1
Engineering Better Gameplay Communication

Objective
Students will use data to justify the need for better gameplay communication technology. Students will design a device to enhance communication in gameplay by using the Engineering Design Process.

Concept
Engineering: Procedures for Testing Prototypes

Time
(3) 55-minute blocks

Module 4.1
The Evolution of the Football Element

Objective
Students will explain how a helmet protects the nervous system by using historical data. Students will explain how a head injury impacts the nervous system and neuron cells. Students will evaluate historic and current helmet technology by discussing how the helmet would protect the player from head injuries.

Concept
Science: Body Systems

Time
(3) 55-minute blocks

STEM Football – Grades 6-8

Module 5.1
Intricacies of a Football Field

Objective
Students will draw and construct a scale model of a football field and goal post by using proportional relationships.

Concept
Math: Portions and Ratios

Time
(1-2) 55-minute blocks

Module 6.1
Extra Point vs Two-Point Conversion

Objective
Students will calculate the probability of a PAT kick success by using real data. Students will be able to predict the number of successful PAT kicks by using a model from collected data. Students will explain how probability can help a team make better decisions by making a claim and supporting it with evidence.

Concept
Math: Probability and Statistics

Time
(1-2) 55-minute blocks

Module 7.1
Integers of Play

Objective
Students will use a football field number line as a model subtract integers. Students will solve word problems using a number line.

Concept
Math: Number line and Integers

Time
(1-2) 55-minute blocks

Module 8.1
Properties and Behavior of Footballs

Objective
Students will calculate the density of a football by collecting measurements of mass and volume. Students will use volume formulas to determine the volume of a football. Students will make a claim about how density affects behavior by using observations.

Concept
Math: Volume of 3-D Objects
Science: Properties of Matter (Density)

Time
(2) 55-minute blocks

STEM Football Products

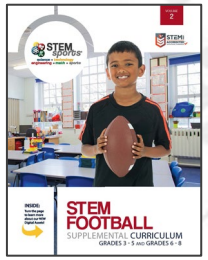
<u>Full Kit</u>

- Multiples of 15 different products in kit
- Repeated use
- Features: Several sizes of football receiver gloves and a walkie-talkie set

<u>Non-Sports Kit</u>

- Without 6 youth footballs & 6 foam footballs, pump, inflation needles and ball bags.

<u>Manual Only</u>



STEM Golf – Grades 3-5

Module 1.0
Golf Measurements

Objective
Students will write an expression converting feet to yards and meters to yards. Students will use real data to measure distance and calculate the remaining distance.

Concept
Math: Measurement and Problem Solving

Time
(1) 60-minute session

Module 2.0
Force of a Golf Swing

Objective
Students will diagram the forces involved in a golf swing. Students will predict how a change in energy will influence the behavior of the ball. Students will design and test an experience that answers the question, how can you increase the distance of a golf ball's flight?

Concept
Science: Forces and Motion

Time
(3) 60-minute sessions

Module 3.0
Scoring in Golf

Objective
Students will explain the mathematical steps for calculating golf scores. Students will compare golf scores using greater than and less than symbols.

Concept
Math: Comparing Values and Expressions

Time
(1) 60-minute session

Module 4.0
Engineering a Pushcart

Objective
Students will brainstorm multiple ideas for a solution to the problem. Students will create a list of potential criteria and constraints. Students will explain how their ideas meet criteria and constraints by presenting to their peers.

Concept
Engineering Design Process

Time
(2-4) 60-minute sessions

STEM Golf – Grades 3-5

Module 5.0
What is a Golf Ball?

Objective
Students will make observations and measurements on different types of materials. Students will explain how properties impact the function of a golf ball.

Concept
Science: Physical Properties

Time
(2) 60-minute sessions

Module 6.0
Angles

Objective
Students will draw a ray segment at multiple angles. Students will collect data in a controlled experiment. Students will make a claim and support it with evidence and reasoning.

Concept
Science: Forces and Motion

Time
(2) 60-minute sessions with Scaffolded Experiment
OR
(3) 60-minute sessions for Student Designed Experiment

Module 7.0
Water in Golf

Objective
Students will describe what grass needs to grow to sustain good playing conditions. Students will create a concept map that demonstrates the input and output of natural resources for grass to grow on a golf course. Students will evaluate desert flood solutions by building a model.

Concept
Science: Plant Growth

Time
(4) 60-minute sessions

Module 8.0
Climate and Weather in Golf

Objective
Students will use climate maps to predict where there would be more golf courses in the world. Students will provide examples of desirable climates to play golf.

Concept
Science: Weather and Climate

Time
(2) 60-minute sessions

STEM Golf – Grades 6-8

Module 1.0
Golf Measurements

Objective
Students will calculate the unknown hypotenuse of a triangle using the Pythagorean Theorem in the real world. Students will use a mathematical formula to determine the area of a sand trap and water hazard on a golf course.

Concept
Math: Geometry

Time
(2) 50-minute blocks

Module 2.0
Forces of a Golf Swing

Objective
Students will design a controlled experiment that tests how the acceleration/distance of the golf ball changes based on the force applied to the ball. Students will explain the relationship between force, acceleration, and mass by using experimental data.

Concept
Science: Force

Time
(2) 50-minute blocks

Module 3.0
Scoring in Golf

Objective
Students will use a number line to solve addition and subtraction of integers. Students will construct a mathematical expression to calculate the final score in a golf game.

Concept
Math: Positive and Negative Numbers

Time
(2-4) 50-minute blocks

Module 4.0
Engineering a Pushcart

Objective
Students will develop a list of important criteria and constraints for designing a pushcart. Students will create a system that evaluates multiple designs using the criterion and contrast they developed.

Concept
Engineering Design Process

Time
(2) 50-minute blocks

STEM Golf – Grades 6-8

Module 5.0
What is a Golf Ball?

Objective
Students will analyze different uses of technology to determine how it meets the criteria and constraints of the problem. Students will answer text-dependent questions about engineering and technology. Students will compare and contrast different solutions to a problem.

Concept
Engineering
Use of Technology

Time
(3) 50-minute blocks

Module 6.0
Angles

Objective
Students will determine the complementary angle in order to diagram a golf club. Students will draw triangles using a protractor. Students will describe the relationship between distance hit and the angle of the golf club.

Concept
Math: Angles
Use of Technology

Time
(3) 50-minute blocks for Student Designed Experiment
OR
(2) 50-minute blocks with Scaffolded Experiment

Module 7.0
Kinetic Energy in Golf

Objective
Students will collect and analyze data that demonstrates the relationship between mass, velocity, and kinetic energy in golf. Students will make a claim about kinetic energy in golf and support their claim with evidence and scientific reasoning.

Concept
Science
Use of Technology

Time
(2) 50-minute blocks

Module 8.0
Climate and Weather in Golf

Objective
Students will draw a diagram that demonstrates how a golf area of the world can have varying weather patterns, different from the area's climate. Students will make a claim about the best air mass interactions for the game of golf and support it with evidence and reasoning about the differences between weather and climate.

Concept
Science: Weather and Climate

Time
(2) 50-minute blocks

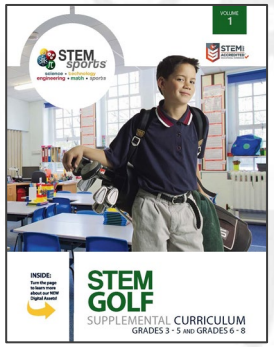
STEM Golf Products

Full Kit

- Multiples of 10 different products in kit
- Repeated use
- Features: ShortGolf® clubs, balls, and targets

Non-Sports Kit – not available

Manual Only



STEM Soccer – Grades 3-5

Module 1.1
Juggling and Energy Transfer

Objective
Students will predict which type of juggle transfers the most energy when they collide using data. Students will predict the distance traveled by using data.

Concept
Science: Forces and Motion

Time
(1) 45-minute session

Module 2.1
Calculating Calories and Heart Rate

Objective
Students will predict and calculate calories burned during gameplay by using multiplication and division. Students will compare values by using calculations and descriptions.

Concept
Math: Multiplication and Division

Time
(1) 90-minute session

Module 3.1
Measuring Throw-Ins

Objective
Students will collect data in meters and convert their data to centimeters dividing by 100. Students will evaluate measurement systems to decide the best measurement size.

Concept
Math: Measurement and Conversions

Time
(1) 60-minute session

Module 4.1
Soccer vs Futsal Ball Systems

Objective
Students will make observations about color, texture, ability, and bounce reactions by recording information in a data table. Students will explain how the Futsal ball and Soccer ball systems behave differently by using data.

Concept
Science: Properties of Matter and Systems

Time
(2) 45-minute sessions

STEM Soccer – Grades 3-5

Module 5.2
Air Molecules in Ball Tuning

Objective
Students will create a model to demonstrate how increasing the pressure of a ball increases the amount of air molecules.

Concept
Science: Molecules

Time
(1) 45-minute session

Module 6.1
The Goal of a Soccer Field

Objective
Students will create a diagram that shows how the biosphere, hydrosphere, geosphere and atmosphere influence a soccer field. Students will design a plan to improve a soccer field by considering the roles of the hydrosphere, biosphere, geosphere and atmosphere.

Concept
Science: Earth's Systems

Time
(1) 45-minute session

Module 7.1
Goal-Line Technology

Objective
Students will create a low-tech goal-line indicator by using the Engineering Design Process. Students will support their decisions for redesign by using data.

Concept
Engineering

Time
(3) 45-minute sessions

Module 8.1
Probability and Penalty Kicks

Objective
Students will predict the outcome of a shootout by determining the larger fraction. Students will write the outcome of a shootout in a mathematical expression by using a greater than symbol.

Concept
Math: Fractions, Greater than/Less than Symbols

Time
(1) 60-minute session

STEM Soccer – Grades 6-8

Module 1.1
Calculating Throw-Ins

Objective
Students will calculate the distance the ball travels through the air during a throw-in by using the Pythagorean Theorem.

Concept
Math: Pythagorean Theorem

Time
(1-2) 50-minute blocks

Module 2.1
Heart Rate and Calories

Objective
Students will create and interpret line graphs by using calculated and collected data. Students will explain the relationship between the MET and time variables by using key vocabulary like increasing, steep, slope, and decreasing. Students will use a line to predict outputs (y).

Concept
Using Technology; Math: Graphing Functions/Slope

Time
(2) 50-minute blocks

Module 3.1
Effective Ball Travel

Objective
Students will calculate the force applied to the ball by using Newton's Second Law. Students will provide evidence of increased motion based on force diagram of the ball.

Concept
Science: Physics; Force and Motion

Time
(2) 50-minute blocks

Module 4.1
Synthetic vs Natural Materials

Objective
Student will explain that balls are made from both synthetic and man-made materials by using observation. Students will record relevant information from the text.

Concept
Technology: Materials and Societal Impact

Time
(1) 50-minute block

STEM Soccer – Grades 6-8

Module 5.2
Pressure and Molecular Motion

Objective
Students will explain how increased pressure in the ball will change molecular motion and behavior of the ball by making a diagram.

Concept
Science: Molecules and Matter

Time
(1) 50-minute block

Module 6.1
Area of Shooting Spaces

Objective
Students will determine the area of a triangle by measuring the base and height.

Concept
Math: Geometry and Area

Time
(1) 50-minute block

Module 7.1
Goal-Line Technology

Objective
Students will create a low-tech goal-line indicator by using the Engineering Design Process. Students will support their argument by using data from a controlled experiment.

Concept
Science and Engineering: Use Evidence to Support Decisions

Time
(3) 50-minute blocks

Module 8.1
Probability and Penalty Kicks

Objective
Students will calculate the probability of penalty kicks. Students will be able to predict the number of penalty kicks by using a model from collected data. Students will explain the benefits and limitations of probability by using data to support their explanation.

Concept
Math: Statistics and Probability

Time
(2) 50-minute blocks

STEM Soccer

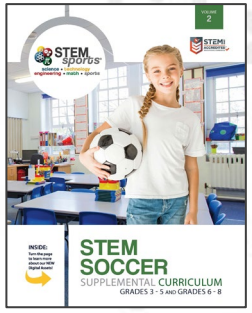
Full Kit

- Multiples of 15 different products in the kit
- Features: 12 soccer balls, including six futsal balls and heart-rate wrist monitors

Non-Sports Kit

- Without 6 soccer and 6 futsal balls, pumps, inflation needles, and ball bags.

Manual Only



STEM Volleyball – Grades 3-5

Module 1.1
The Volleyball Court

Objective
Students will measure the area and perimeter of a polygon by using a square tile and a tape measure. Students will calculate the perimeter and area of a polygon by using a formula and dimension (either measured or given).

Concept
Math: Area and Measuring

Time
(2) 45-minute sessions

Module 2.1
Geometry of a Volleyball Net

Objective
Students will construct a volleyball net with points, lines and angles using everyday materials. Students will diagram and label the parallel and perpendicular lines on a volleyball net. Students will identify the angles in a volleyball net.

Concept
Math: Angles and Lines; Engineering Design Process: Building and Design

Time
(2) 60-minute sessions

Module 3.1
Volleyball Properties

Objective
Students will make observations about color, texture, ability, and volley reactions by recording information in a data table. Students will explain how the First Touch, Light Touch and Recreation balls behave differently by using data.

Concept
Science: Observations and Physical Properties

Time
(2) 45-minute sessions

Module 4.1
Successful Serving

Objective
Students will predict their chances of a successful serve by determining the larger fraction. Students will write a mathematical expression by using greater than and less than symbols to order the chances of making a successful serve with both types of volleyball.

Concept
Math: Fractions and Greater than Less than Symbols

Time
(1) 60-minute session

STEM Volleyball – Grades 3-5

Module 5.1
Improving Serving

Objective
Students will create and perform a controlled experiment to determine the best method to improve a serve. Students will evaluate an experiment to determine if the data collected supports a hypothesis.

Concept
Science: The Scientific Method

Time
(2) 45-minute sessions

Module 6.1
Speed of the Volleyball

Objective
Students will use greater than and less than symbols to represent the speed of different volleyball hits. Students will describe how ball energy and speed are related by using data collected by a radar gun.

Concept
Math: Greater than/Less than Symbols; Science: Speed and Energy

Time
(2) 45-minute sessions

Module 7.1
Calculating Total Force

Objective
Students will design an experiment that collects evidence on gravity and pushing forces on the ball. Students will justify their explanation by using key terms of balanced and unbalanced forces.

Concept
Science: Balanced and Unbalanced Forced

Time
(2) 45-minute sessions

Module 8.1
Adaptive Technology

Objective
Students will use the Engineering Design Process to solve a problem for adaptive volleyball players. Students will test their prototype in order to determine a redesign. Students will communicate their results by presenting their ideas and prototype to peers.

Concept
Engineering Design Process

Time
(2-3) 45-minute sessions

STEM Volleyball – Grades 6-8

Module 1.1
Intricacies of a Volleyball Court

Objective
Students will draw and construct a scale model of a volleyball court and net by using proportional relationships.

Concept
Math: Proportions and Scale

Time
(2) 55-minute blocks

Module 2.1
Communication and Drills

Objective
Students will write repeatable procedures. Students will analyze written communication to determine how to improve for better results.

Concept
Science: Writing Procedures

Time
(2) 55-minute blocks

Module 3.1
Volleyball Properties

Objective
Students will measure volume and mass. Students will calculate and compare the densities of several types of volleyballs. Students will make a claim about how density of a volleyball affects performance.

Concept
Science: Properties of Matter, Density and Synthetic Material

Time
(2) 55-minute blocks

Module 4.1
Successful Serving

Objective
Students will calculate their number of successful serves by using probability calculations. Students will graph and interpret probability data by answering questions.

Concept
Math: Probability

Time
(1) 55-minute block

STEM Volleyball – Grades 6-8

Module 5.1
Improving Serving

Objective
Students will create and perform a controlled experiment to determine the best method to improve an impact serve. Students will evaluate an experiment to determine if the data collected supports a hypothesis.

Concept
Science: Controlled Experiments and Claims

Time
(2) 55-minute blocks

Module 6.1
Kinetic Energy and Speed

Objective
Students will be able to compare the kinetic energies through various volleyball hits by measuring the speed of a volleyball using a radar gun.

Concept
Science: Kinetic Energy, Mass and Relationships

Time
(1) 55-minute block

Module 7.1
Calculating Total Force

Objective
Students will use actual data to determine the amount of force acting on the ball using Newton's Second Law.

Concept
Science: Force, Acceleration and Mass (Newton's Second Law)

Time
(1) 55-minute block

Module 8.1
Adaptive Technology

Objective
Students will use the Engineering Design Process to solve a problem for adaptive volleyball players. Students will test their prototype in order to determine a redesign. Students will communicate their results by presenting his/her ideas and prototype to peers.

Concept
Engineering: Design Process and Prototype Testing

Time
(2-2) 55-minute blocks

STEM Volleyball Products

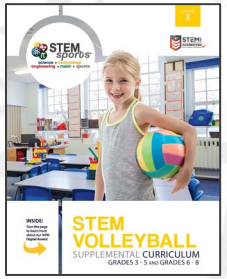
<u>Full Kit</u>

- Multiples of 15 different products in kit
- Long shelf-lives
- Features: 18 volleyballs and one Bushnell Radar Gun

<u>Non-Sports Kit</u>

- Without 18 volleyballs, pump, inflation needles and ball bags

<u>Manual Only</u>



STEM Multi-Sport – Grades 3-5

Module 1.1
Improving Serving

Objective
Students will create and perform a controlled experiment to determine the best method to improve a serve. Students will evaluate an experiment to determine if the data collected supports a hypothesis.

Concept
Science: The Scientific Method

Time
(2) 45-minute sessions

Module 2.1
Probability and Penalty Kicks

Objective
Students will predict the outcome of a shootout by determining the larger fraction. Students will write the outcome of a shootout in a mathematical expression by using a greater than symbol.

Concept
Math: Fractions, Greater than/Less than Symbols

Time
(1) 60-minute session

Module 3.1
Properties of a Football and Foam Football

Objective
Students will divide a football into equal areas by using a diagram. Students will explain how the properties of a football including shape, affect the football's behavior.

Concept
Science: Properties of Matter

Time
(1) 90-minute session

Module 4.1
Advancements in Shoe Technology

Objective
Students will make detailed observations by using their senses and measurements to make inferences about changes in technology.

Concept
Science: Observation

Time
(2) 45-minute sessions

STEM Multi-Sport – Grades 3-5

Module 5.1
The Volleyball Court

Objective
Students will measure the area and perimeter of a polygon by using a square tile and a tape measure. Students will calculate the perimeter and area of a polygon by using a formula and dimension (either measured or given).

Concept
Math: Area and Measuring

Time
(2) 45-minute sessions

Module 6.1
Calculating Calories and Heart Rate While Playing Soccer

Objective
Students will predict and calculate calories burned during gameplay by using multiplication and division. Students will compare values by using calculations and descriptions.

Concept
Math: Multiplication and Division

Time
(1) 90-minute session

Module 7.1
Technological Advancements and Improved Quarterback Play

Objective
Students will collect data and display it in a bar graph. Students will use a bar graph to make a claim about the effectiveness of receiver gloves.

Concept
Math: Graphs

Time
(1) 55-minute session

Module 8.2
Shot Tracking

Objective
Students will compare fractions based on their free throw accuracy by using the greater than and less than symbols.

Concept
Math: Fractions

Time
(1) 60-minute session

STEM Multi-Sport – Grades 6-8

Module 1.1
Improving Serving

Objective
Students will create and perform a controlled experiment to determine the best method to improve an impact serve. Students will evaluate an experiment to determine if the data collected supports a hypothesis.

Concept
Science: Controlled Experiments and Claims

Time
(2) 55-minute blocks

Module 2.1
Probability and Penalty Kicks

Objective
Students will calculate the probability of penalty kicks. Students will be able to predict the number of penalty kicks by using a model from collected data. Students will explain the benefits and limitations of probability by using data to support their explanation.

Concept
Math: Statistics and Probability

Time
(2) 50-minute blocks

Module 3.1
Arm Strength: Youth vs Foam Football

Objective
Students will collect and graph data of a controlled experiment by using a line graph. Students will explain the relationship between kinetic energy, mass and speed by writing a claim evidence, reasoning paragraph based on class data.

Concept
Science: Energy and Motion

Time
(2) 55-minute blocks

Module 4.1
Advancements in Shoe Technology

Objective
Students will use qualitative data to evaluate and improve shoe technology by using the Engineering Design Process.

Concept
Engineering

Time
(2) 50-minute blocks

STEM Multi-Sport – Grades 6-8

Module 5.1
Intricacies of a Volleyball Court

Objective
Students will draw and construct a scale model of a volleyball court and net by using proportional relationships.

Concept
Math: Proportions and Scale

Time
(2) 55-minute blocks

Module 6.1
Heart Rate and Calories

Objective
Students will create and interpret line graphs by using calculated and collected data. Students will explain the relationship between the MET and time variables by using key vocabulary like increasing, steep, slope, and decreasing. Students will use a line to predict outputs (y).

Concept
Using Technology; Math: Graphing Functions/Slope

Time
(2) 50-minute blocks

Module 7.1
Technological Advancements and Improved Quarterback Play

Objective
Students will calculate their number of passes they could complete in a season by using probability calculations. Students will graph and interpret probability data by using technology and answering questions.

Concept
Math: Graphs and Probability

Time
(2) 55-minute blocks

Module 8.2
Shot Tracking with Technology

Objective
Students will use data collected to make a claim using evidence from technology by interpreting graphs.

Concept
Science and Math: Process of Science, Statistics

Time
(2) 50-minute blocks

STEM Multi-Sport 3-8 Products

<u>Full Kit</u>

- Multiples of 20 different products in the kit
- Long shelf-lives
- Features: 29 total balls and six heart-rate wrist monitors

<u>Non-Sports Kit</u>

- Without 29 different balls, pump, inflation needles, and ball bags.

<u>Manual Only</u>

STEM Multi-Sport – Grades K-2

Module 1.0
Playing Footsie: Forces in Soccer

Objective
Students will learn about the behavior of a soccer ball by planning and carrying out an investigation through practice. Students will determine which drills increase and decrease the speed of the ball for better ball control.

Concept
Science: Forces and Interaction
Math: Measurement

Time
(2) 30-minute sessions or
(1) 45-minute session

Module 2.0
Penalty Shootout: Kicks and Probability

Objective
Students will learn about chance (probability) in soccer through penalty kicks. Students will plan and carry out an investigation to support their findings using the Scientific Method.

Concept
Math: Addition, Subtraction, and Measurement

Time
(2) 30-minute sessions

Module 3.0
Properties: Pee-Wee Football vs Foam Football

Objective
Students will make observations and measurements of pee-wee and foam footballs. Students will explain how the properties of a football, including shape, affect the football's behavior.

Concept
Science: Properties of Matter
Math: Measurements

Time
(2) 30-minute session

Module 4.0
Catch Me If You Can

Objective
Students will find an "ideal" distance to play catch by planning and carrying out an investigation to support their findings using the Scientific Method.

Concept
Math: Measurements

Time
(2) 30-minute sessions

STEM Multi-Sport – Grades K-2

Module 5.0
Basketball Matters

Objective
Students will make observations about color, texture, ability to stretch, and state of matter of materials by recording information in a data table. Students will explain there is air inside the ball by comparing an empty ball and an inflated ball. Students will explain why balls behave differently by using observations about the solid and gases that make up the balls.

Concept
Science: States of Matter, Observations

Time
(2) 30-minute sessions

Module 6.0
Design a Shoe

Objective
Students will study the advancements in shoe design from the first basketball shoe to today's shoes. Students will design their shoes using the Engineering Design Process.

Concept
Engineering Design Process
Science: Observations
Use of Technology

Time
(2) 30-minute sessions

Module 7.0
Finding the Sweet Spot: Force of a Golf Swing

Objective
Students will learn about the force of a golf swing by planning and carrying out an investigation through practice. Students will determine how accuracy and precision relates to applied force.

Concept
Science: Forces and Interaction

Time
(1) 45-minute session or
(2) 30-minute sessions

Module 8.0
Engineer a Hole-In-One

Objective
Students will use the Engineering Design Process (EDP) to solve the problem of a golf ball not going in the hole.

Concept
Engineering Design Process

Time
(1) 45-minute session or
(2) 30-minute sessions

STEM Multi-Sport K-2 Products

<u>Full Kit</u>

- Multiples of 20 different products in the kit
- Long shelf-lives
- Features: 29 total balls and six heart-rate wrist monitors

<u>Non-Sports Kit</u>

- Without 29 different balls, pump, inflation needles, and ball bags.

<u>Manual Only</u>

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