VOLUME
1

STEM sports
science • technology
engineering • math • sports

STEM.ORG ACCREDITED
EDUCATIONAL EXPERIENCE

INSIDE:
Turn the page to learn more about our NEW Digital Assets!

STEM LACROSSE

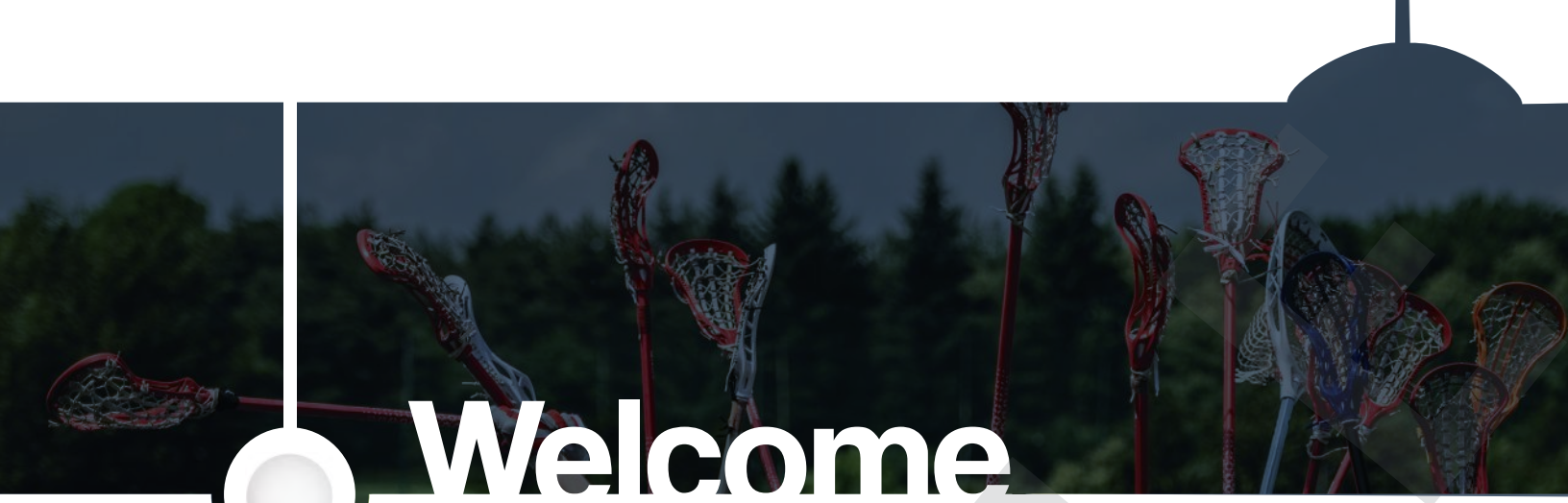
SUPPLEMENTAL CURRICULUM

GRADES 3 - 5 AND GRADES 6 - 8

Go Digital

In addition to the classroom, STEM Sports® K-8 Supplemental Curriculum is flexible and scalable to teach and implement at home and virtually on platforms such as Zoom, Google Classroom, Skype, and other digital learning tools. For each and every module, we provide solutions for successful remote learning with PowerPoint presentation decks and digital worksheets with keys.

To access these useful tools, visit www.STEMSports.com/lacrossedigitaltools/



Welcome

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

We are pleased to present Volume 1 of STEM Lacrosse, highlighted by the following:

- Content for a minimum of 16 hours of instruction that includes some healthy, physical activity.
- Turnkey kits equipped with all of the relevant sports equipment along with the necessary science supplies.
- Eight lessons aligned with Next Generation Science Standards (NGSS) and/or Common Core State Standards (CCSS) and/or National Standards for K-12 Physical Education.
- STEM.org Accredited™ Educational Experience approved
- 5E lesson plans so that students will develop 21st-century skills such as critical thinking, collaboration, creative problem-solving, and leadership.
- Differentiation: lessons for Kindergarten to 2nd graders, 3rd to 5th graders, and lessons for 6th to 8th graders.
- "Capstone" Project (Grades 6th to 8th) to commensurate student's knowledge of each curriculum.
- Assessments in each lesson to evaluate students effectively.
- Ready-to-use worksheets that align with each lesson and standards.
- A list of STEM-based, sports-related jobs pertinent to the lesson concept in each module.
- Engineering Design Process (EDP) woven into each curriculum.
- STEM Sports® glossary to support instructors and students as they come across key vocabulary in each module.
- Mindfulness Matters: important messaging to assist with the uniqueness of blending STEM with sports.
- Well designed and scalable for teachers, administrators, or volunteers.
- Professional development or training are not required.

Please visit www.STEMSports.com for additional information and to learn about all of the curricula that we offer.

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

Please complete our Teacher Survey at www.stemsports.com/teacher-survey.
We appreciate your feedback.

Mindfulness Matters

Mindfulness may not be the first thing 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:

- 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.

Contents

Grades 3-5

Contents

Grades 6-8

Module 5.0
Predicting Potential Energy

PAGE 56

Objective
Students will describe how the position of a lacrosse stick will influence the potential energy in the system. Students will draw a shooting technique diagram and label the potential and kinetic energy.

Concept
Science: Force, Acceleration, and Mass

Time
(2) 50-minute blocks

Module 6.0
Passing with Accuracy

PAGE 60

Objective
Students will ask a testable statistical question. Students will explain how a variable, like distance or cradling, impacts the probability of a successful pass. Students will calculate the probability of a successful pass based on real world data.

Concept
Math: Statistics and Probability

Time
(2) 50-minute blocks

Module 7.0
Headgear

PAGE 63

Objective
Students will describe the engineering design process as a cycle. Students will review data about safety equipment to determine criteria for success. Students will brainstorm new solutions for safety equipment.

Concept
Engineering Design Process

Time
(3) 50-minute blocks

Module 8.0
Wearable Technology

PAGE 69

Objective
Students will use points on a quadrant plane to measure the length between points for a lacrosse play. Students will demonstrate and explain how technology in lacrosse can improve play.

Concept
Math: Coordinate Points
Use of Technology

Time
(2) 50-minute blocks

Capstone
Using sports to understand the contribution of Indigenous people to Modern society, including STEM.

PAGE 74

Objective
Students will explain the origins of Lacrosse as a model for exploring contributions by Native Americans in STEM. Students will use a simple framework to analyze Indigenous discoveries and concepts in STEM.

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Lacrosse Supplies Checklist

- [ ] **Six (6)** Lacrosse Balls
- [ ] **Six (6)** Lacrosse Sticks
- [ ] **One (1)** Cut (halved) Lacrosse Ball
- [ ] **One (1)** STEM Lacrosse Curriculum Manual
- [ ] **Twenty-four (24)** Disc Cones
- [ ] **One (1)** Digital Weight Scale
- [ ] **Six (6)** 25 Foot Tape Measures
- [ ] **Six (6)** Digital Stop Watches
- [ ] **One (1)** Fishing line Spool
- [ ] **One (1)** Package of Straws (100)
- [ ] **One (1)** Box of Toothpicks (500)
- [ ] **Six (6)** Ribbon Spools
- [ ] **Six (6)** Masking Tape Roles
- [ ] **One (1)** Ball of String

Materials Needed

- [ ] Pencils
- [ ] Paper/Notebook
- [ ] Cardboard
- [ ] Chart Paper or Whiteboard
- [ ] Styrofoam
- [ ] Various Sport Balls: tennis, golf, baseball, softball, and ping pong
- [ ] Outdoor Space
- [ ] Copies of Scaffolding support (*if necessary)*

Lacrosse

STEM Sports® Glossary

Acceleration: Change in speed over time.

Angle: A figure formed by two rays that have the same endpoint.

Balanced Force: Two forces acting in opposite directions on an object, equal in size.

Constraint: A restriction that keeps something from being the best it can be.

Criteria: A set of rules or directions that must be followed.

Engineering Design Process (EDP): An organized series of steps that engineers use to develop functional products or processes.

Force: Something that causes a change in the motion of an object.
Force = mass of object x acceleration

Framework: A structure underlying a system, idea, or text.

Function: The relationship or expression involving one or more variables.

Kinetic Energy: The energy an object possesses due to its motion.

Line (Segment): The part of a line with two endpoints.

Point: An element in geometry that has position but does not extend.

Potential Energy: The energy possessed by a body as a result of its position or condition, as opposed to its motion.
PE = mgh (mass X gravity x height)

Properties: Any traits that can be measured, such as mass, color, density, length, odor, and temperature.

Ray: The part of a line with one endpoint that goes on forever in the opposite direction.

Technology: An object, idea, or method used to solve problems or invent new objects, ideas, or methods.

Unbalanced Force: A force that changes the position, speed, or direction of the object to which it is applied.

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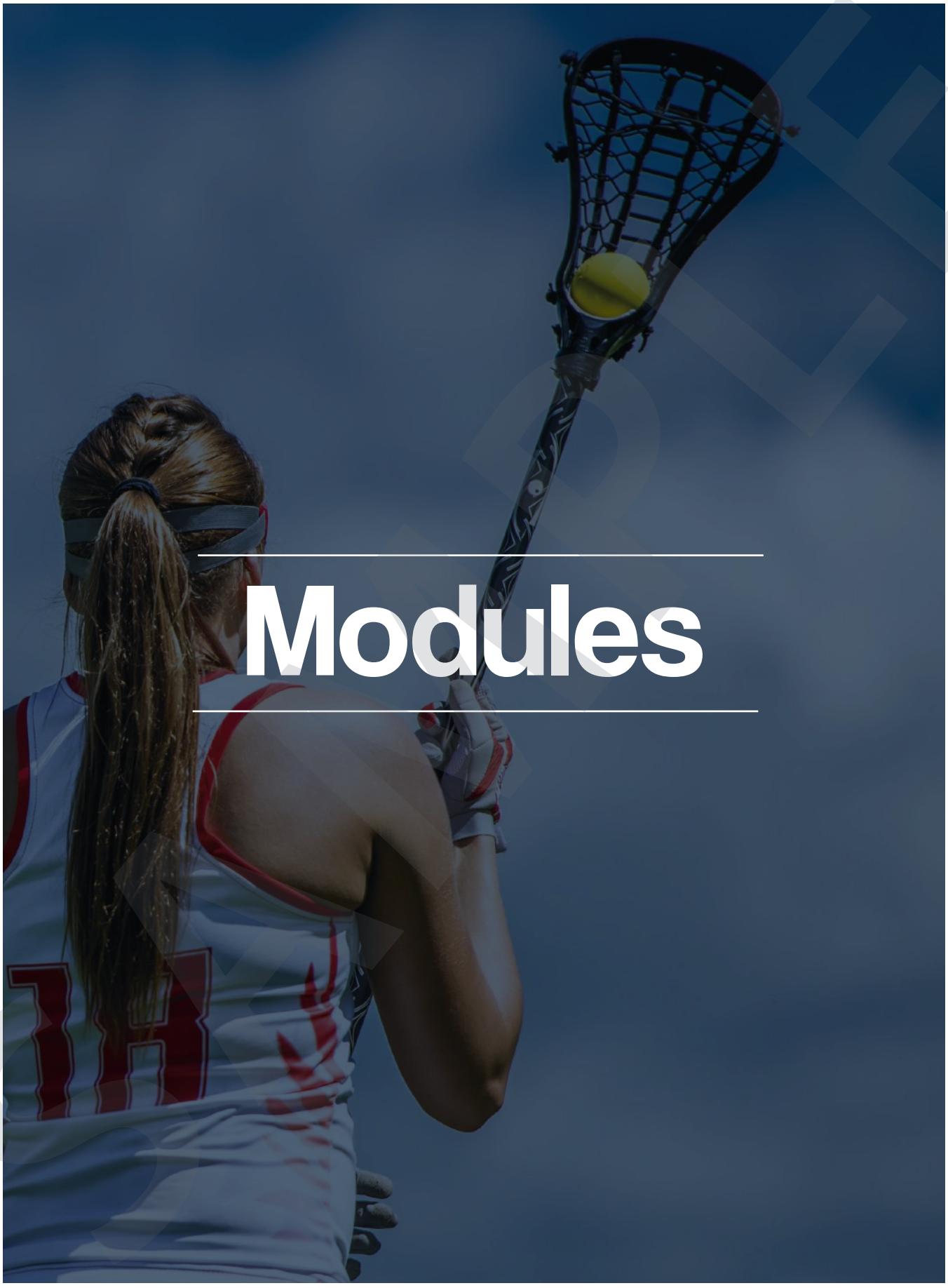

Modules

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Module 8.0

GRADES 3-5

Wearable Technology

Concept
Science: Observations
Technology: Information and Instrumentation

Objective
Students will observe and gather information on wearable technology. Students will determine if technology can produce equipment to track and enhance a player's movement and performance.

Time
(2) 50-minute sessions

Standards

Next Generation Science Standards Connections

4-PS3-2.
Make Observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.

4-PS4-3.
Generate and compare multiple solutions that use patterns to transfer information.

Cross Cutting Concepts

- Patterns: Similarities and differences in patterns can be used to sort and classify designed products. (4-PS4-3)

National Standards for K - 12 Physical Education Connections

Standard 2: The physically literate individual applies knowledge of concepts, principles, strategies and tactics related to movement and performance.

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

Supplies Provided
Worksheets

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

Materials Needed
Pencils

Video
Precision Science - Technological Advances in Sports: STEMsports.com/resources/resources-lacrosse/

Sequence of Lesson

Have your students take this lesson's assessment prior to engaging by visiting:
www.stemsports.com/assessments
If you have limited digital capability, please email Info@STEMSports.com to access the Assessment & Key.

Engage: Have students discuss the following with a partner: Is there sports equipment that can track and improve an athlete's performance?

Explore: Show students the video on Precision Science - Technological Advances in Sport by going to STEMSports.com, then click on STEM Lacrosse under Resources.

Explain: Define Criteria and Constraints, which can be found in the STEM Sport® Glossary in the front of this manual and at STEMSports.com under Resources. Tell students that science can find and determine if a product will be successful, or if further testing is needed in order to solve the problem. Explain that when testing a product, a pattern of criteria and constraints should be recognized and developed to construct a good product.

Define Energy and Energy Transfer, which can be found in the STEM Sport® Glossary in the front of this manual and at STEMSports.com under Resources. Give examples of energy transfer in sports and technology.

- Sports: Chemical energy (food) to mechanical (motion) energy.
- Technology: Electrical current (charging a battery) to light energy (the light on a smartwatch face).

Have an informal discussion about when they could see energy transfer in sports or technology in the video. Replay as needed.

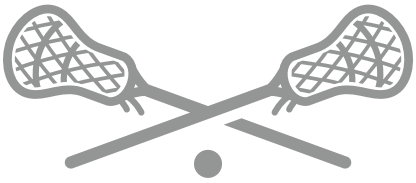
Elaborate: Using the worksheet, create a list of criteria and constraints, similar to pros/strengths and cons/weaknesses. Examples may include:

Criteria	Constraints
Track a player's performance	Very expensive
Lightweight/ easy to use	Uses synthetic materials

Evaluate: Using the worksheet, determine what piece of technology meets criteria or avoids constraints using energy.

Have your students retake this lesson's assessment to effectively evaluate their comprehension by visiting:
www.stemsports.com/assessments
If you have limited digital capability, please email Info@STEMSports.com to access the Assessment & Key.

Extend: Based on their findings in *Evaluate*, students could give a presentation to their peers about wearable technology that limits the use of energy and resources, yet performs well on the lacrosse field.



STEM Jobs in Sports

- Lacrosse: NCAA League Official
- Replay Official
- Team Merchandise Designer
- Internet Sports Producer
- Sports Videographer

Fun Fact

Lacrosse is one of the fastest growing sports in the United States.

Name: _____

Wearable Technology

GRADES 3-5

Elaborate

Criteria	Constraints

Name: _____

Wearable Technology

GRADES 3-5

Evaluate

Visual	Use of Energy/Resources	Meets Criteria	Avoids Constraint
Video Camera	Potential energy to electrical energy		
Clip Board	No energy transfer		
Helmet Camera	Potential energy to electrical energy		
Speaker	Potential energy to sound energy		
GPS Tracker	Potential energy to electrical energy		
Smartwatch	Potential energy to light energy		

Module 7.0

GRADES 6-8

Headgear

Concept
Engineering Design Process

Objective
Students will describe the engineering design process as a cycle. Students will review data about safety equipment to determine criteria for success. Students will brainstorm new solutions for safety equipment.

Time
(3) 50-minute blocks

Standards

Next Generation Science Standards Connections

MS-ETS1-3
Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.

National Standards for K - 12 Physical Education Connections

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

Supplies Provided
Worksheets and Article
Extend only: Lacrosse Sticks

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

Materials Needed
Pencils, Chart Paper or Whiteboard, Helmet or Headgear and Eye Protection (real or images)
Extend only: Cardboard or Styrofoam and other Prototyping Materials

Sequence of Lesson

Have your students take this lesson's assessment prior to engaging by visiting:
www.stemsports.com/assessments
If you have limited digital capability, please email Info@STEMSports.com to access the Assessment & Key.

Engage: Have students look at the images of women's vs. men's protective equipment on page 65. Using the worksheet, have students record things they notice (observations), things they wonder (questions), and things they think (opinions or inferences).

Explore: Have students read the article on page 64 about injuries and safety equipment.

Helmet Safety

We see helmets in a large variety of sports, from football to cycling to hockey. Even baseball players wear helmets when they are at bat. In Lacrosse, men wear helmets and women don't. This is the only sport to have such a distinct difference in safety equipment across each gender. So much so, that it is against the rules for women to wear a hard sided helmet in the game. The Center for Disease Control (CDC) tells parents in the Heads-UP Campaign that although there is no concussion-proof helmet, wearing a helmet can protect against head injuries. In their handout on lacrosse helmets, it does note that girls are no different in this reasoning.

What reasoning do the governing organizations have to only require helmets for one gender? One reason may be the rules regarding contact in women's lacrosse: there is less physical contact. However, this does not account for incidents involving sticks hitting a player's head, a ball hitting a player's head, and/or accidents where physical collisions do occur. In fact, research in the early 2000's found that head and face injuries were more common in women at 30%, compared to men's 20% (Gale, 2001). The majority of the women's injuries involve the ball and the majority of the men's injuries involve another player. Clearly, this reason is not well founded in research. Even in non-physical contact sports like baseball and softball require both women and men wear helmets to protect themselves from the ball.

In sum, safety should always be a top priority for all players: men and women. Particularly for a contact sport such as lacrosse. And while the number of participants in contact sports such as hockey and football are not female, protective headgear is still required for those

More than 170,000 kids and teens are treated in an emergency department each year for sports- or recreation-related traumatic brain injuries, including concussions.

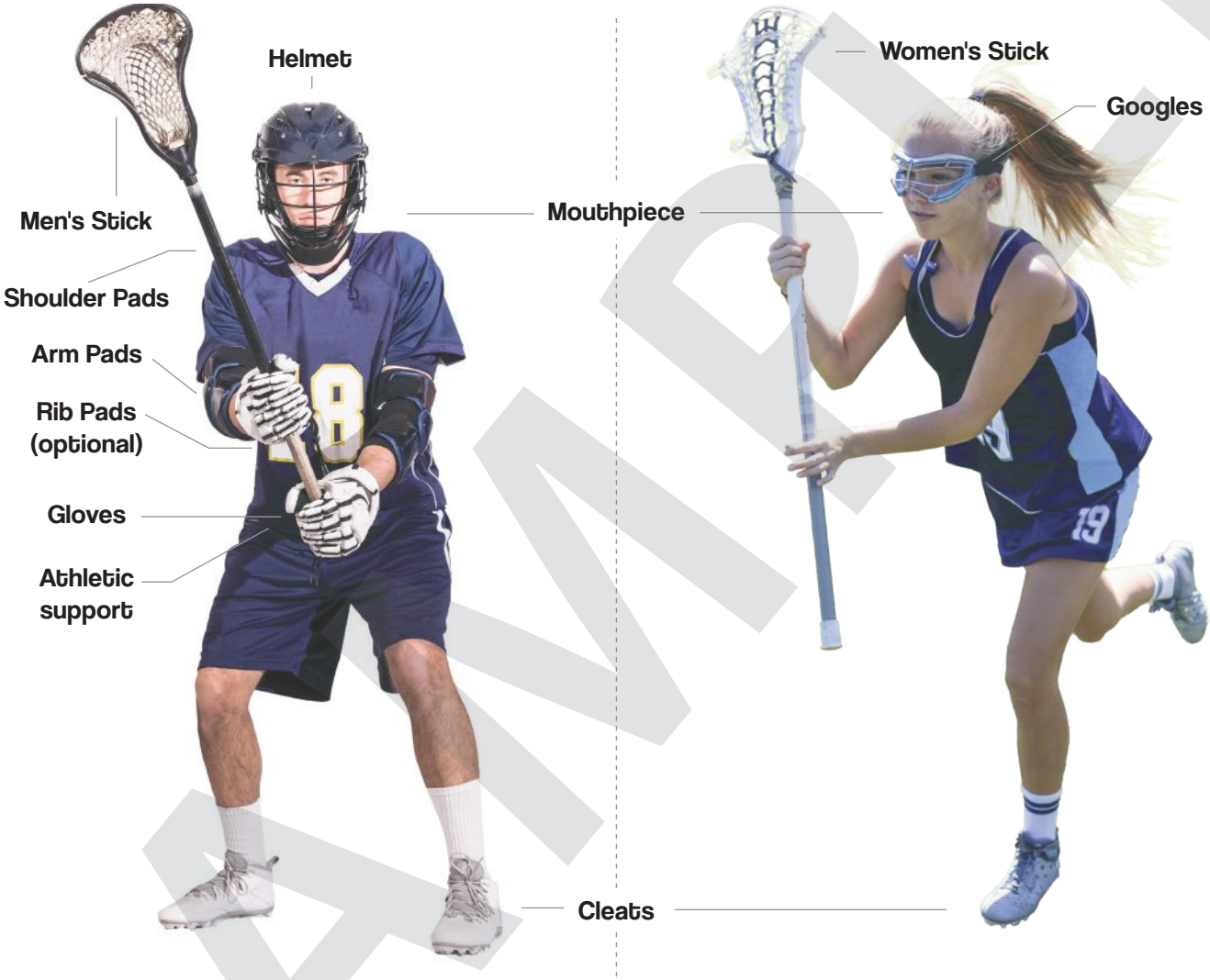
women participating. As the game of lacrosse continues to grow, should safety protocols remain the same or change to protect all participants in the future?

Sources:
Diamond PT, Gale SD. Head injuries in men's and women's lacrosse: a 10 year analysis of the NEISS database. National Electronic Injury Surveillance System. Brain Inj. 2001 Jun;15(6):537-44. doi: 10.1080/02699050010007362. PMID: 11394973.

https://www.cdc.gov/headsup/helmets/index.html

https://www.everydayhealth.com/concussion/should-high-school-girl-lacrosse-players-be-required-to-wear-the-same-helmets-as-high-school-boys/

Men's vs. Women's Lacrosse Gear



Explain: Review the steps of the Engineering Design Process with students. Explain that helmets have already been engineered, so they will be working on Step 5 of the EDP to improve. Ask students to consider their ideas from *Engage* and what they read about in *Explore* to consider what improvements can be made to the safety equipment.

Explain that once the engineering design cycle is complete, it restarts. As you consider improvements, start again to ask about the problem and then imagine new ideas.

Define Criteria and Constraints, which can be found in the STEM Sports® Glossary in the front of the manual and at STEMSports.com under Resources. Work with students to list criteria and constraints for successful safety equipment. Reference examples in the table on the next page.

Engineering Design Process

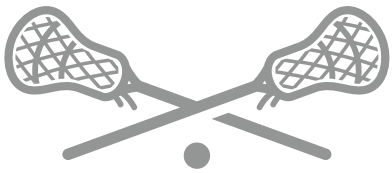
Criteria	Constraints
Protects the head from concussion.	Doesn't limit visual performance.
Protects the eyes from the ball and stick.	Conforms to league rules.

Elaborate: Have students review the worksheet to see the similarities and differences in the safety equipment for men and women's lacrosse. Have students complete the Venn diagram provided on the worksheet.

Evaluate: Have students use their brainstormed improvement list from *Engage* and their criteria and constraint lists from *Explain* to imagine several design solutions for safety equipment for men's and women's lacrosse.

Have your students retake this lesson's assessment to effectively evaluate their comprehension by visiting:
www.stemsports.com/assessments
If you have limited digital capability, please email Info@STEMSports.com to access the Assessment & Key.

Extend: Prior to the *Evaluate* section, students could perform tests on the safety equipment for men's vs. women's equipment. Similar to an "egg drop," students could use cardboard or styrofoam to create a helmet from one water balloon, using rubber bands and padding to create eye protection for another. Students could drop each from 3 to 5 feet to simulate falling and record observations. Students could hit each balloon with the shaft of the stick to simulate being hit in the head with a lacrosse stick and record their observation.



STEM Jobs in Sports

- Sports Helmet Engineer
- Stadium or Arena: Safety Inspector
- Lacrosse: Product Development Scientist
- Team Physician
- Strength and Conditioning Coach

Fun Fact

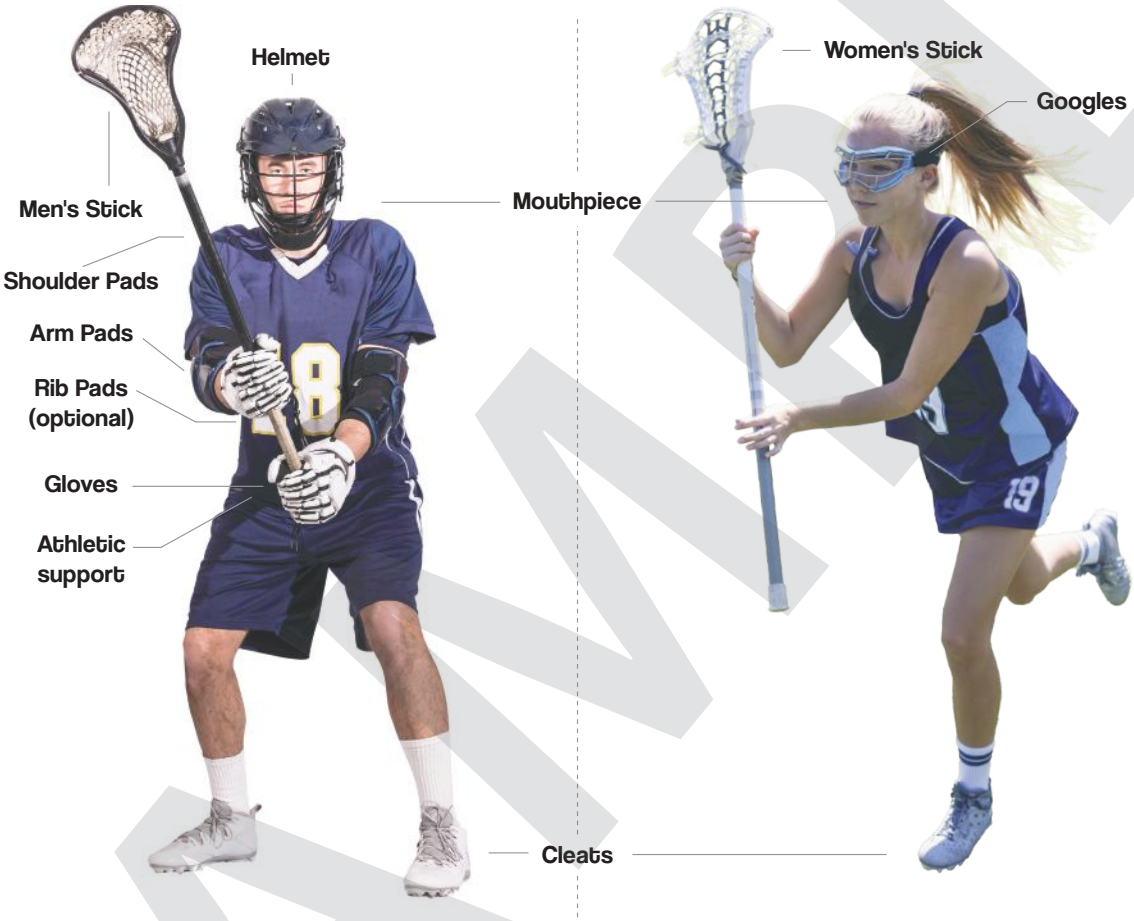
Lacrosse has only been officially played in the Olympics twice: 1904 and 1908.

Name: _____ Class: _____

Headgear

GRADES 6-8

Men's vs. Women's Lacrosse Gear



I notice...	I wonder...	I think...

Name: _____ Class: _____

Headgear

GRADES 6-8

Men's required helmet	Women's required 'Head' protection	Women's optional 'soft sided' Helmet
		

Women's Both Men's

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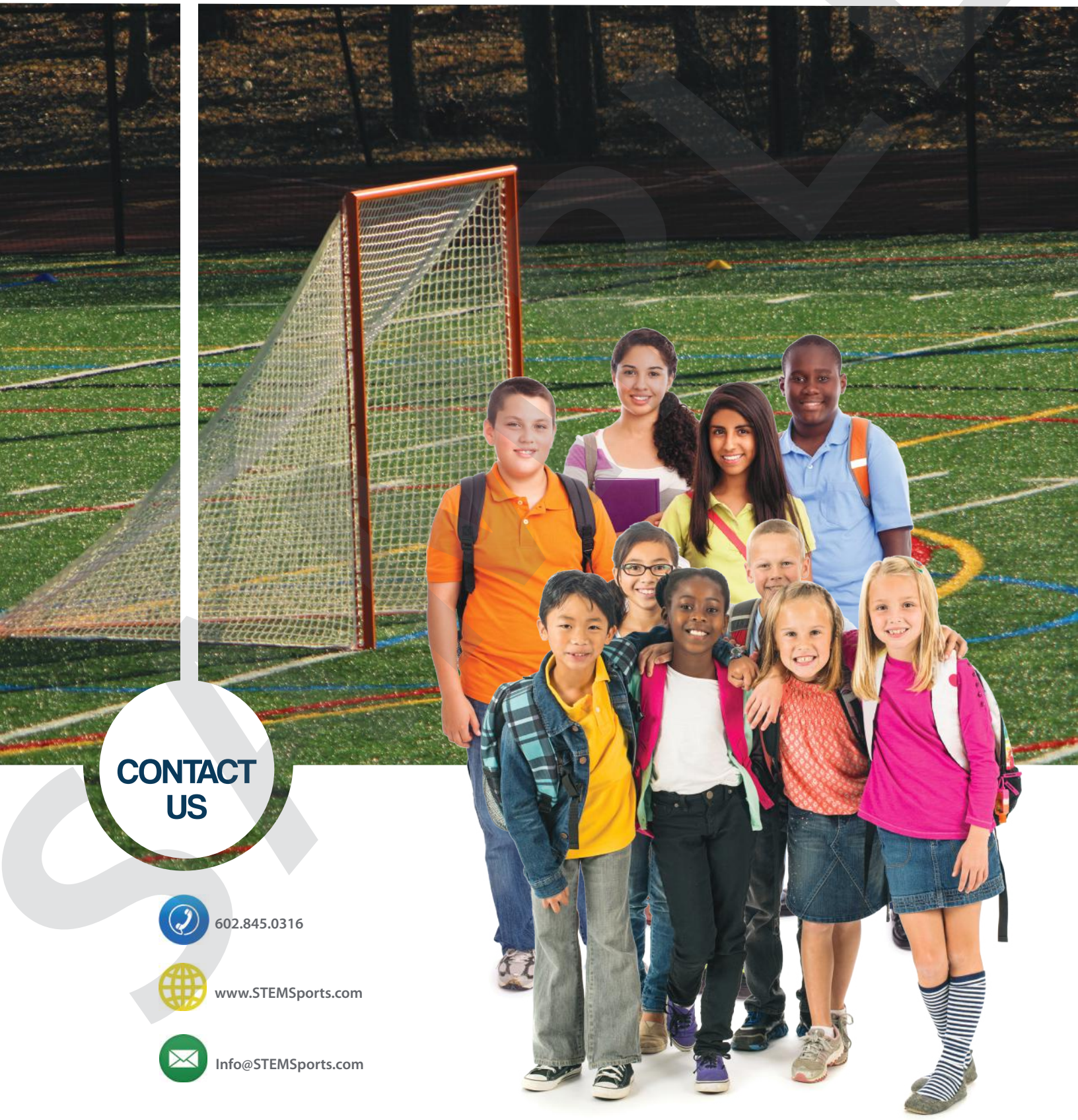

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