STEM sports®

THE Winning Equation

How to Teach STEM Through the Lens of Sports

Think back to the first time you tried to ride a bike.

Did you read textbooks to understand the physics, forces, energy, and friction needed to make it happen? Or did you take the hands (and feet) on approach by hopping on the bike to feel the forward momentum, test the friction of the brakes, and figure out the pedaling force?

You chose to hop on the bike. We all did.

In the end, both methods encompassed physics, forces, energy, and friction. However, one method used real-life experience and physical understanding to bring those subjects to life.

This is the same principle you will learn about throughout this ebook. STEM concepts don't have to be intimidating. They can be fun, exciting, relevant, and easily retained if they have the right context.

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CHAPTER 1: **KICKOFF**

The Vital Role of STEM in Shaping the Future

STEM is an acronym commonly used when referring to science, technology, engineering, and mathematics.

These subjects teach students critical thinking, problem solving, creativity, teamwork, and collaboration. They also prepare students to pursue careers in STEM related fields - which are growing 20 percent faster than any other industry. Providing students with a quality STEM education is critical for building a pipeline of skilled employees to meet the labor demand.

10 FASTEST GROWING STEM CAREERS

- Clinical Data Managers
- Data Scientists
- Human Factors Engineers and Ergonomists
- Industrial Engineers
- Manufacturing Engineers
- Validation Engineers
- Aerospace Engineers
- Chemists
- Electrical Engineers
- Bioinformatics Scientists

SOURCE

STEM education teaches students both hard and soft skills that will benefit them in the classroom and in their personal lives.

When students are given the opportunity to engage in quality STEM education, there are tangible benefits that will be seen by the student, educators, and parents.

Collaboration

Students will work with others toward a common goal.

Critical thinking

Students will be required to work through projects and pivot to solve problems and challenges.

Project Management

Students will experience intricate projects that need proper time management and prioritization.

Innovative thinking

Students will get to think outside of the box and tap into a creative mindset.

Knowledge Application

Students will apply their learning to real-time and real-life scenarios to further comprehension.

Introducing students to STEM at an early age has proven to be an effective strategy to foster lifelong interest. However, this is only half of the solution.

Students also want answers to the age old questions, "Why does this matter?" and "When am I going to use this?" Relating STEM subjects to topics that students connect with in their daily lives is an approach that increases retention, understanding, and prolonged interest.

Up next: In chapter two we will uncover how incorporating sports concepts into STEM instruction can be a winning combination for student comprehension.

Students exposed to four or five technology-related topics in school are:

- Over two times more likely to choose a STEM related major in college.
- Over two times as likely to want a future STEM career.
- Over five times more likely to be employed in a STEM position.

SOURCE

CHAPTER 2: **GAME PLAN**

Exploring the Intersection of STEM and Sports

The idea of learning science, technology, engineering and math concepts can be daunting and even tedious for students.

One way to overcome this challenge is to use sports as a way to facilitate STEM education. This unique combination promotes critical thinking through physical activity. Active learning through sports gives students a real world situation where the STEM concepts are applicable.

Let's look at four examples of how sports can be applied to learning science, technology, engineering, and math.

> *"In STEM we would normally just do worksheets and that doesn't really make me want to do it. Learning STEM through sports makes it more interesting for me."*
>
> - Middle school student from Kansas

Science In Sports

5E's This lesson follows the 5E Model of Instruction.

Learning in Practice: Forces in Basketball

Students understand that dropping a basketball will cause it to bounce back up into the air. It's how dribbling works while playing the sport. Did you know this simple concept can be used to teach physics, motion, and gravity? Here's how.

Get a free sample of this STEM Basketball lesson!

Engage

Allow students to dribble a basketball and observe the difference in height depending on the surface and downward force applied.

Explore

Ask students to conduct experiments measuring total height and number of bounces when dropping a basketball from different heights.

Explain

Teach students that gravity occurs when the ball bounces and that dribbling occurs when a combination of gravity and force are placed on the ball.

Elaborate

Have students reflect back and discuss how they can change the motion/energy of the ball to get a different result.

Evaluate

Ask students the following questions:

- Why does the motion of the ball change when you push on it vs. drop it?
- How does gravity change the motion of a basketball if it is further away from the ground?

SCIENCE CONCEPTS TO TEACH THROUGH SPORTS

- Energy
- Force
- Friction
- Gravity
- Motion
- Nutrition
- Weather and Climate

Technology In Sports

5E's This lesson follows the 5E Model of Instruction.

Learning in Practice: Headgear

Some sports require protective gear to keep athletes safe while playing the game. Technology plays a crucial role in designing this gear, specifically, headgear that protects players while also remaining functional during play. Students can learn about this balance through observing and evaluating the effectiveness of headgear in lacrosse. Here's how.

Engage

Ask students to discuss if they have ever worn a helmet before and what sports require the use of a helmet.

Explore

Play this video on designing and constructing a lacrosse helmet to give students insight into the minds and thought process of engineers.

Explain

Discuss the Engineering Design Process with students and how it can be used to create new technology. Explain how the design and development of a plan may differ depending on whether a helmet is used for youth lacrosse, college lacrosse, or adult lacrosse.

Elaborate

Have students design a low-tech version of a lacrosse helmet using the Engineering Design Process. Ask them to brainstorm, prototype, and test.

Evaluate

Have students present their designs to the class using evidence to support their decisions.

TECHNOLOGY CONCEPTS TO TEACH THROUGH SPORTS

- Analytics
- Environmental monitoring
- Equipment design
- Performance testing
- Predictive analysis
- Robotics
- Sustainable practices

Engineering In Sports

5E's This lesson follows the 5E Model of Instruction.

Learning in Practice: Design a Shoe

Almost every sport has a designated shoe. The construction of those shoes are intentional and meant to improve performance for players. This concept can be used to teach students about the Engineering Design Process. Here's how.

Engage

Have students describe their favorite pair of shoes and explain if they would be suitable for playing sports or playing outside. Explain why or why not.

Explore

Have students study different pictures of shoes and discuss how shoes have changed over time. What is new? What is the same? Why do they think parts have evolved?

Explain

Tell students about the similarities and differences between observations and inferences. Explain how detailed observations can provide scientific data to make inferences.

Elaborate

Ask students the following questions:

- What are your shoes made of?
- Why is there rubber on the bottom?
- What do laces help with?
- Why are "slip-on" shoes not used in sports?
- What kind of material is on the outside vs. the inside of the shoe?

Evaluate

Have students remove one of their shoes and record their observations. Allow them to draw, measure, and use their senses (no tasting!) to generate additional inferences.

ENGINEERING CONCEPTS TO TEACH THROUGH SPORTS

- Equipment design
- Adaptive equipment design
- Material performance enhancement
- Injury prevention
- Stadium design
- Training facility design
- Sustainable design
- Accessible facility design

Mathematics In Sports

5E's This lesson follows the 5E Model of Instruction.

Learning in Practice: Measuring Throw-Ins

Students know a throw-in happens in soccer when the ball goes out of bounds. It's an opportunity for one team to put the ball back in play in the exact spot they want. But to make it to that exact spot, the player throwing the ball has to use the right technique. Students can learn which technique works best by measuring and converting the distance of the ball using varying throw-in methods. Here's how.

Engage

Have students conduct throw-ins while standing still, kneeling, and stepping into the throw. Ask them to observe which produces the best results.

Explore

Ask students to measure how far the ball travels after each throw, measuring the results in meters.

Explain

Teach students how to convert using the Metric System.

Elaborate

Have students convert each of their meas`urements from meters to centimeters.

Evaluate

Ask students the following questions:

- Which of the three throw-in techniques was the best and why.
- Which measurement is better to use on the soccer field, meters or centimeters and why.

MATH CONCEPTS TO TEACH THROUGH SPORTS

- Geometry
- Probability
- Statistics
- Proportions and ratios
- Timing and distance
- Units and conversions

CHAPTER 3: **COACHING TACTICS**

Strategies for Teaching STEM Through Sports

In the Classroom

Teachers play a pivotal role in fostering student success in STEM. It's essential for them to actively seek out and implement strategies to enhance student engagement and build excitement in STEM subjects. Use these approaches to help make abstract STEM concepts tangible for students inside the classroom.

Implement Project-Based Learning (PBL) to build teamwork

PBL can easily be applied to STEM and sports because both are heavily centered around teamwork and collaboration. Ask students to work together on projects that make STEM relatable to real-life applications.

- Design their own mini-golf course using angles and friction.
- Conduct experiments to measure how different sports balls bounce on a variety of surfaces.
- Create a stadium model focusing on geometry and engineering.

Hand the lesson over to guest speakers.

Invite athletes and coaches to share how STEM concepts impact performance.

Learn through hands-on, pre-built lessons

Enjoy teaching STEM with standards-aligned curriculum designed around sports concepts. STEM Sports curriculum kits are available in 11 sports and each provide more that 16 hours of STEM instruction.

Discover STEM Sports Curriculum Kits

Incorporate real-world connections

Link STEM curriculum content to real-world scenarios to help students see the relevance and application of their studies. For example, you can align lessons to big sporting events taking place, such as the Super Bowl, Olympics, or World Series. If students are already talking about these topics, it is a perfect opportunity to capture their attention and turn it into a learning experience.

Provide practicum for all learners

Establish an environment that reaches all students and encompasses mental, emotional, and physical discernment. Special education students thrive in environments that explore the concepts of STEM using sensory and abstract skills. For example, physically investigating the composition of a basketball, golf ball, pickleball, and soccer ball will help students understand how each property is uniquely designed for that sport.

Discover the STEM Sports Special Teams Players Kit

At Camps, Clubs, or After School Programs

After school programs, camps, and clubs don't have to shy away from learning. Lean into the fun and active side of STEM to provide the perfect learning environment for kids in these organizations.

Build interactive learning stations

Create stations with different sports-related STEM activities for students to rotate through.

- Measure heart rate and physical fitness using heart monitors and stopwatches to explore biology and physiology.
- Experiment with different grips and pitches using baseballs and radar guns to learn about aerodynamics and motion.
- Analyze how high kids can jump and what factors impact results to understand force and energy transfer.

DOWNLOAD A FREE SAMPLE OF THIS ACTIVITY!

Go on field trips

Organize trips to visit sports facilities or sporting events to experience STEM up close. You can discuss how STEM relates to stadium design, athlete performance, and even have kids meet with players to hear how STEM is used in their position.

Host a STEM competition day

Plan an entire STEM day that blends sports and STEM together. Put kids in teams and assign projects, such as building a new piece of sports equipment that enhances safety, and watch their creativity and STEM knowledge take center stage.

Follow a STEM program made for any level of leader

It can be difficult to find STEM programming that can be taught by any after school educator, coach, or camp leader regardless of their own STEM knowledge. STEM Sports curriculum & kits are filled with step-by-step instructions and resources to teach STEM without any training or prior STEM background needed.

Discover STEM Sports curriculum kits

At Home

STEM education can be a daunting subject area for parents and children alike. Creating a fun, safe space for children to explore science, technology, engineering, and math, helps set them up for success in their education and future job.

Conduct sport science experiments

Show students how simple experiments link sports to STEM. You can measure how different surfaces affect the bounce of a basketball, or use a stopwatch to track running times and discuss factors that influence speed.

Sign up for a STEM Sports All-Star Kit

The STEM All-Star Kit introduces kids ages 8-14 to STEM concepts behind the sports they already know and love. The kit includes basketball, football, soccer, and volleyball equipment and supplies, plus nine STEM lesson manuals - enough to keep your student learning STEM for an entire year.

See Kit Details

Engage in family projects

Get the entire family involved for learning of all ages. You can engineer a backyard obstacle course or put everyone to the test with a fitness challenge, complete with metric tracking and graphing the results.

Learn from the professionals

Watch sports events together and discuss all the science, technology, engineering, and math taking place behind the scenes. You can discuss strategies used by athletes, analyze statistics presented during the game, and even break down the technology used to broadcast the event.

Almost ⅓ of STEM college students say their parents had the biggest influence on their decision to pursue STEM.

SOURCE

CHAPTER 4: **IN THE GAME**

Steps to Implement STEM Learning in Sports

Play the long game

As stated at the beginning of this ebook, teaching STEM is only half of the equation for successful and prolonged interest in the field. Students need to know the long term vision for how STEM applies to their future.

Students need to receive pre college information early and often to properly prepare them for their future studies in STEM.

Best STEM colleges, universities, and technical schools

- Massachusetts Institute of Technology (MIT)
- Georgia Institute of Technology
- California Institute of Technology (Caltech)
- Stanford University
- Harvey Mudd College
- University of California, Berkeley
- Texas A&M University
- University of Michigan
- Illinois Institute of Technology
- New Jersey Institute of Technology
- Rochester Institute of Technology
- Stevens Institute of Technology (Hoboken, NJ)
- Virginia Tech
- Worcester Polytechnic Institute
- Rensselaer Polytechnic Institute (Troy, NY)

Popular STEM majors

- Biology
- Chemistry
- Computer Science
- Engineering
- Health Sciences
- Information Technology
- Astronomy
- Mathematics
- Physics

The average high school GPA for a high-performing STEM major is 3.86

SOURCE

Pursuing a professional athletic career isn't the only option for students passionate about sports.

There are endless STEM-related careers that align perfectly with the world of sports. Introducing these options can guide students towards exciting and motivating career pathways.

Provide the pathway to STEM success

Higher education prep is crucial, but so is long term vision. Providing students with career pathway options that are in high demand and offer lucrative earnings can be a powerful motivational factor.

Fastest Growing STEM Careers

- Data Scientist
- Information Security Analyst
- Statistician
- Web Developer
- Software Developer
- Computer and Information Research Scientist

Top Paying STEM Careers

- Radiologist
- Aerospace Engineer
- Network Architect
- Software Developer
- Epidemiologist
- Nuclear Engineer
- Information Security Analyst
- Statistician

Summary

We hope the content within the ebook has provided you with insight and inspiration into the future of STEM.

So often we see athletics and academics as separate entities within education. Our goal is to embrace the pair as a powerful combination that can bring context, excitement, and long-term STEM interest to students everywhere.

Let's continue to explore the possibilities together and inspire lifelong learners and future innovators.

> *"It's better when you do it to learn it, not just sit and talk about it."*
>
> - Middle school student explaining why they enjoy learning STEM through sports

Additional Resources

Discover STEM related blogs that cover a wide range of topics about STEM education, sports in education, STEM trends, learning activities, and more.

www.STEMSports.com/blogs

About STEM Sports

Since its inception in 2016, STEM Sports® has grown considerably, with its curriculum being implemented in schools, after-school programs, and camps across the United States. Our growth can be attributed to the ever-growing need for engaging and appealing STEM curricula and STEM activities so that young students can see potential careers early in their educational path.

STEM Sports® will continue to drive the importance of supporting young students throughout their academic journey by providing a product and service that is both educational and enjoyable and implementable with ease for everyone in the education space.

For more information, visit our website at www.STEMSports.com.