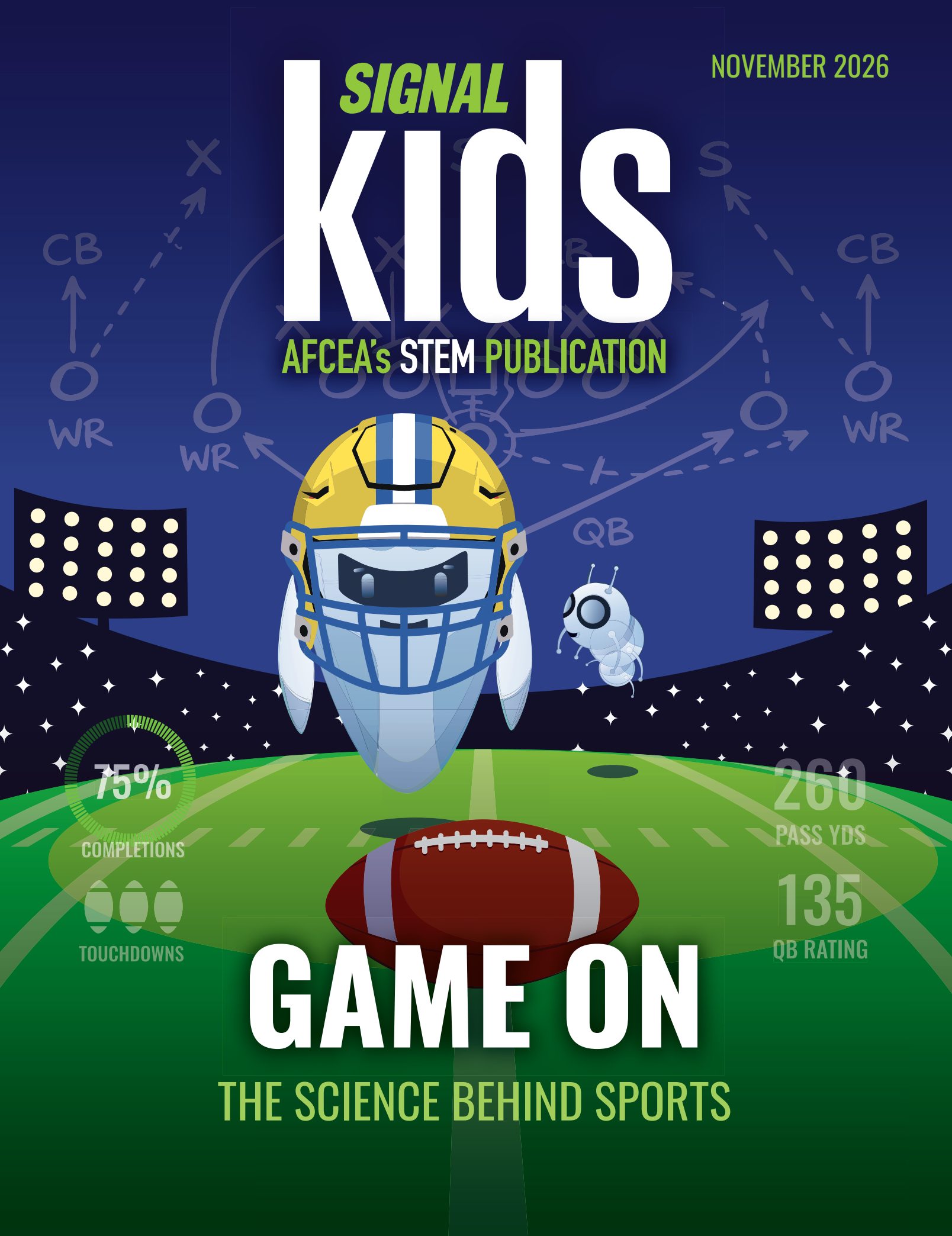
NOVEMBER 2026

SIGNAL kids

AFCEA's STEM PUBLICATION



GAME ON

THE SCIENCE BEHIND SPORTS

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NOVEMBER 2026 ISSUE SPONSORED BY:

Lt. Gen. Susan Lawrence, USA (Ret.), former president and CEO, AFCEA International



SPORTS are one of the most popular activities. According to the Sports & Fitness Industry Association's 2026 report, 250 million Americans played a sport or participated in a fitness activity in 2025! Maybe you are an athlete, a fan or both. Playing a sport is so much more than kicking or throwing a ball. Every sport involves science.

Physics is the study of force and motion, so it explains how energy is used while people play sports, why soccer balls curve in the air and how figure skaters can spin on the ice for so long.

Some sports involve a lot of math and geometry. Baseball players track how well they are playing with statistics, and golfers read the greens to decide the best angle to hit the ball.

The technologies used in sports are also impressive! Engineers design protective gear, advanced sports equipment and training supplies. Professional sports teams have athletic trainers, physical therapists and nutritionists who know how to take care of the human body and make players stronger.

You don't just have to be strong to play sports. You also have to be smart!



Have you ever heard someone refer to a football as a pigskin? Don't worry, they don't say that because footballs used to be made from pigs' skin. The first footballs were made with pig bladders instead! Pig bladders can be filled with air like balloons, so back in the 1500s, people put inflated bladders inside leather covers to make footballs and other balls for sports.

The oldest football that still exists today was found at Stirling Castle in Scotland. Historians believe the ball was made around 1550 and was potentially used by Mary, Queen of Scots, who played football, tennis and golf, according to historical writings. You can see it on display today at the Smith Art Gallery and Museum in Stirling, Scotland.



BATTER UP!

Baseball Puts the M in STEM

BY COURTNEY BENEDETTO AND EVAN LYNCH

All sports involve STEM, but baseball and math fit like a glove. Deciding which players are the best in the league often comes down to the numbers.

Charts filled with different statistics can be confusing, so that's when statistical analysts, like Mike Petriello, come into play. Mike joined MLB.com in 2016 as a baseball writer. Now, as the director of stats and research, he works closely with Statcast, which is Major League Baseball's (MLB's) automated tracking system that measures every action on the field and logs the data.

Mike's job is to make sense of all the numbers.

"We are the ones who create all the fancy metrics, figure out how to visualize them and present them, and make them fun and interesting, and in a way that doesn't sound like algebra class," Mike said.

These days, Mike said he spends time making sure broadcasters, writers and teams have the correct statistics to share with their audiences.

BASEBALL TECHNOLOGY

Baseball has always been a numbers game, recording batting averages, home runs and strikeouts. The technologies that track baseball statistics have evolved over time.

MLB formed in 1903, but an advanced database didn't exist across the league until 2008, when all MLB ballparks started using PITCHf/x to track pitch types and pitch speeds.

Statcast was introduced in 2015 and could track batted balls and players, including how fast the ball flies off the bat, how far the ball travels and how fast players run the bases.

In 2020, MLB added the Hawk-Eye system to Statcast. The Hawk-Eye system uses multiple high-speed video cameras that track the motion on the field. For baseball, the system can calculate the angle that pitchers throw the ball, the way batters swing and even which direction the ball spins. This system is also used in sports like tennis and soccer.

"[The Hawk-Eye system] opened up a whole lot of doors over the last five or six years. Everything keeps improving," Mike said.

With advanced technologies, players can improve faster by analyzing videos of successful batters and pitchers. Plus, teams and fans can keep track of baseball's most impressive stats.

Illustrations from Adobe Stock by Ethan 9field) and PONG (batter).

SPOT THE DIFFERENCE ON THE SLOPES





Leh-stock.adobe.com



There are 10 differences in the two photos on the left. See how many of them you can find.



Lenovo provided cameras for the World Cup referees to wear. Can you spot it above his ear?

Lenovo

BIGGER GOALS FOR TECHNOLOGY

BY EZRA MANCARI, AGE 12

Some version of soccer has been around for more than 2,000 years, and the modern game has been around for about 163 years. Even though the sport has stayed the same in many ways, technology is changing how the game is played.

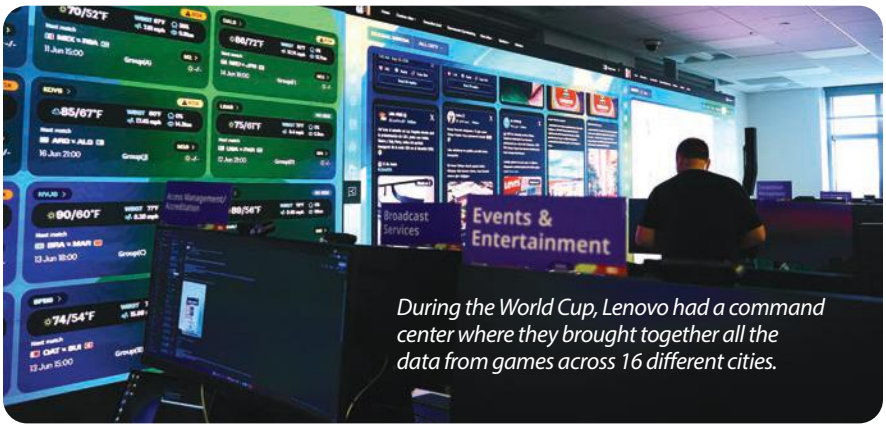
Lenovo is one of the biggest tech companies in the world. One out of every four computers bought in the world comes from Lenovo.

Lenovo asked themselves, "What is the biggest thing in the world that we can do?" That led them to think of the FIFA World Cup.

I got the chance to interview the chief communications officer of Lenovo, Jeffery Shafer, about the positive ways that technology is improving the game, and here is what I learned.

HUNDREDS OF MILLIONS OF DATA POINTS EACH MATCH

Did you know that there are hundreds of cameras all over the stadium? And that there is a data chip inside the soccer ball? The cameras tell where the players are and what they are doing, and the chip tells where the ball is and when it was touched. Lenovo processes all that data and sends a picture to the referees. One thing that the information can help them with is making more accurate calls.



During the World Cup, Lenovo had a command center where they brought together all the data from games across 16 different cities.

There are also cameras on the referee that let you see the field from their angle. And Lenovo uses artificial intelligence (AI) to make the picture smoother, so you don't get so seasick. Without this, it would be shaky and not easy to watch.

MAKING SOCCER PLAYERS INTO AVATARS

If you watched the World Cup, you might remember 3D avatars. To make the avatars, they actually brought players like Messi, Mbappe, Ronaldo, Lamine Yamal and other players into a big white dome that Lenovo created. Inside the dome, there were 24 cameras all around, which took pictures of them in only one second, and then they were an avatar. In total, Lenovo created 1,248 avatars of not only players, but backups and alternates too. Sometimes the camera angle isn't enough, so replays from the avatars give extra information about what is happening in the game.

A FAIR SHOT FOR EVERY TEAM

Do you ever wonder how some of those small teams like Cabo Verde and Curaçao put up a really good fight with the bigger teams? Lenovo



Lenovo created 3D digital avatars for all 1,248 players competing in the World Cup. They built these from individual scans and special AI processing.

actually played a role in helping them do that. Lenovo used something called AI Pro. AI Pro is a tool that every team, every player, every coach and even every scout could use to quickly get information about the game and the players. It gives them access to all of FIFA's data from all around the world.

"If you are Argentina or France, you might send 50 people to a game to watch the players and enter in data. But if you're Haiti or if you're Cabo Verde, you might have one guy. So how does one guy compete with 50 guys? You can do it using technology," Shafer said. And then, when all the teams can compete, the game gets better.

It's crazy to think of all the ways technology is evolving the game, even though at the end of the day, the sport itself is the same as it has been for 163 years. It makes you wonder what the game could be like at the next World Cup or even another century from now.



ABOUT THE KID REPORTER

Ezra Mancari is a 12-year-old at Carl Sandburg Middle School in Alexandria, Virginia. He loves swimming and running, and he was a reporter on his school's news crew.



FROM FOOTBALL TO STEM: HOW TIM JOHNSON IS MAKING THE GAME SAFER

BY LYDIA ANTONIO-VILA

This month, we got to speak with Tim Johnson, former NFL linebacker for the Baltimore Ravens! Tim Johnson played for the Chicago Bears, NFL Europe Rhein Fire and Oakland Raiders. He also played for the Calgary Stampeders in the CFL to finish his football career.

Originally from Fairfield, Alabama, Tim has always loved football. But after his NFL career, he decided to use what he learned about the game to help make football safer for young athletes.

Tim graduated from Youngstown State University in Ohio. While there, his main project was about youth sports and ways to make football safer, especially when it comes to concussions.

What is a concussion?

A football concussion is a brain injury that can happen when the head takes a hard hit. The most common signs of a concussion include headache, blurred vision, nausea, dizziness and sensitivity to light. It's important you tell an adult if you feel any of these symptoms after playing an impact sport.

Tim started Head Impact Prevention Football League, or H.I.P. Football, in 2017. It's an 11-11 football league for kids that teaches alignment, assignment and technique. But there's a twist: Tim wanted kids to learn how to play the game before they started tackling.

Tim's company also partners with students at the College of STEM at Youngstown State University to produce helmets. The H.I.P. helmets are made using 3D printing, and they use biomimicry tools to mimic the way natural materials, like animal shells, respond to impact.

What is biomimicry?

The practice of solving human problems by copying nature. In this case, imitating animal beaks or shells to create a football helmet.

These tools help Tim's team mimic animal features like the ram's horns or an armadillo's skin.

"All of those animals have natural defense mechanisms that prevent them from being crushed or getting concussions, like when the rams butt heads."

The H.I.P. helmets also have impact sensors and heart rate sensors, as well as an EEG monitor, a medical device that records the electrical activity of the brain.

Tim's goal is to continue to grow the sport of football, make it safer and include more girls and women in the game.

"Let's keep innovating and let's keep STEM at the forefront of innovation and in the future," he said.



Shore Fire Media

Shawn Johnson won the gold medal for balance beam at the 2008 Beijing Summer Games! She also won three silver medals for individual all-around, floor exercise and the team competition.

Going for Gold With STEM

MY INTERVIEW WITH SHAWN JOHNSON



BY CLARA LILLY, AGE 8

I got to interview Shawn Johnson, a World Champion and Olympic gold medal gymnast. We talked about the technology and science behind gymnastics. I also do gymnastics, so I was super excited when I found out I got to interview her!

Shawn started gymnastics when she was 3 years old. She didn't use technology with her gymnastics for a long time, but when she was training for the Olympics, they used cameras to see the skills that they did. "We could go back and look at the skill that we just practiced, and we could slow it down, and we could measure angles and see it from all different angles," Shawn said.

Shawn tracked data and statistics for her gymnastics. They would look at the scores of other people's performances and her performances to compare them. "We would measure difficulty values and execution values and see where we could strategically get a little bit better."

She said your body is like a car with fuel. If you don't give it enough fuel, then it will run out of gas. "I was taught by my coach that the better I slept and the better I ate, the better my muscles and my body would work to perform for me during practice and competitions," Shawn said. She told me to take my sleep and eating very seriously.

I asked her how you get the right amount of speed and momentum when you do an event like the vault. And she said that was a great question, especially if you like science. They studied and learned that you actually don't run at full speed on the vault. "So for us, we would probably run at like a 70% pace for us, because that actually generated more power and momentum for us when we got to the vault."

Now we're going to talk about how gymnasts can tell where they are in the air when they are flipping and twisting so fast. In her gym, they called it "air sense." They would practice it every day for 15-20 minutes on a really long trampoline called a tumble track.

She asked if I had ever played the game "add on." Add on is a game where your coach gives you a skill; for example, they will say, "Do a straddle jump." Then they will say, "Do a straddle jump then do a split jump." Then you keep adding on doing flips and twists and all these cool moves. "What we were doing was training our mind and our eyes to keep up with all the different directional changes. And we would do that every single day. And that would help us train our minds so when we're in the air, flipping really fast or really high, our eyes and our brain know exactly where we are."

Shawn doesn't know if artificial intelligence (AI) will be part of

gymnastics in the future. She says there's a lot of room for creativity in gymnastics, and maybe AI could help. "I think we saw with Simone Biles, she unlocked a whole new level of difficulty in our sport. So maybe with technology and AI, we can kind of use it as a helper to tell us what more we can do."

Shawn was on Dancing with the Stars. Dancing with the Stars is a TV show that is a dance competition where teams compete for the mirror ball trophy. Shawn won! And she got to dance with Derek Hough. She said it was very different than gymnastics and kind of the same because you have to control your body, but it was more freestyle.

Shawn's favorite event in gymnastics was the balance beam. "It made me feel like a superhuman superhero whenever I landed a skill," Shawn said. And she said "bars" was the scariest for her.

I asked Shawn what her advice for kids was. "I think our world takes sports a little too seriously these days. And the best thing you can do as a kid is to have fun, because when you face hard times or challenges, if you really love it, it makes it easier to get through."



ABOUT THE KID REPORTER

Clara is in third grade and lives in Alexandria, Virginia. She loves animals, art and gymnastics. She wants to be a veterinarian, teacher and an Olympic gymnast when she grows up.

PAPER GOLF GAME

NO NEED FOR CLUBS!

Just grab some colored pencils, dice and some friends for a fun round of paper mini golf.

INSTRUCTIONS:

1) All players start at the golf ball. Player 1 rolls the die and then picks which direction to move the ball (up, left, right or diagonal). The number on the die is how many dots the player can connect in a single turn. Each player must move in one continuous direction per turn unless they bounce off an obstacle. Draw a line from where you start to where you land at the end of your turn.

a. If a player has no choice but to move their ball into the sand trap, add one stroke to their overall score.

b. If a player has no choice but to hit their ball into the water or off the map, roll again.

c. Players can bounce off of obstacles and use the remaining spaces to move in the new direction.

2) The next player rolls the die, picks a direction and moves the number of dots rolled. The player draws a line and marks where the ball lands in a different color pencil.

3) Continue taking turns rolling and moving the ball until all players reach the hole. Players do not need to roll the exact number of dots to reach the hole.

4) The player who drew the fewest lines wins!



Sponsored by Lt. Gen. Susan Lawrence, USA (Ret.), former president and CEO, AFCEA International

One of Gen. Lawrence's personal goals is to golf in all 50 states! Her support of this issue helps bring fun activities like this golf challenge to SIGNAL *Kids readers everywhere.*

Winter Olympics: Where Sports Meet STEM

What happens when you bring the Winter Olympics into the classroom? STEM comes to life! Third-grade teachers Carolyn Haroth and Sara Kyse of Crofton Woods Elementary School turned their students into athletes, scientists and engineers with action-packed Winter Olympics challenges.

SKIING DOWN THE HALL

Students grabbed their "skis" *(dish towels)* and raced down the hallway! They timed each race, recorded the results and then put the times in order from fastest to slowest. Students learned how to read and compare numbers, organize data and determine who had the fastest time.

TABLE HOCKEY

In Olympic table hockey, students competed to earn points while keeping track of their scores. They practiced mental math by quickly adding points, keeping track of changing scores and figuring out who was ahead.



SKI JUMPING CHALLENGE

For the ski jumping event, students created little paper ski jumpers and used straws to blow them through the air. Students tested their jumpers, then used a tape measure to measure the distance of each jump. This introduced students to engineering concepts like testing, changing a design and seeing whether those changes improved the results.

OLYMPIC DATA SCIENTISTS

Of course, no Olympic competition would be complete without keeping track of the results. Students created graphs and charts to show things like how many medals were won and how athletes or teams performed. By turning the results into graphs, students could easily see patterns, compare results and answer questions about the data.

For more information on how the AFCEA Central Maryland Chapter supports STEM teachers and students, visit centralmd.afceachapters.org

SPORTS TECHNOLOGY

San Diego is home to many sports teams, including the Padres of MLB, San Diego FC of Major League Soccer and the Division I San Diego State University basketball team. There are so many new technologies that protect athletes and make sure sports are played fairly. Here are some of the coolest and newest technologies in the sports world.



AI-ENABLED NFL TABLETS

Last football season, the NFL and Microsoft teamed up to add artificial intelligence (AI) to the tablets that coaches carry on the sidelines during games. The AI quickly finds past plays and their outcomes to help coaches decide what plays to call next. Coaches used to scroll through data, but with AI, they can filter their search and find successful formations in seconds.



SOCCER BALL SENSORS

FIFA collaborated with Adidas to make a new sensor system within soccer balls called connected ball technology. In the 2026 FIFA World Cup, the soccer balls had advanced sensors inside that tracked the ball's movement, position on the field and each time it was touched by a player. Referees were able to track the exact moment of contact to decide if players were offside or if they touched the ball with their hands at any point in the game. The sensors were designed to make sure the right fouls are called by referees.

SWEAT-BASED WEARABLE BIOSENSORS



To keep track of athletes' health while they are playing their sport, scientists and engineers have designed small sensors that athletes can wear. When the sensor touches sweat, it can read how much sodium or lactate is in the sweat. If the sensor detects too much sodium, that may mean that the person is dehydrated. If the sensor detects too much lactate, that means the person is exercising too much, and the muscles are not getting enough oxygen.

AFCEA San Diego supports STEM education and connects students with the people and technologies shaping our future. Visit sandiego.afceachapters.org to learn more.

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