Northeastern University
College of Engineering

Weekly STEM Newsletter - Week 34 (APRIL 05 - APRIL 12, 2021)

The Science of Sports

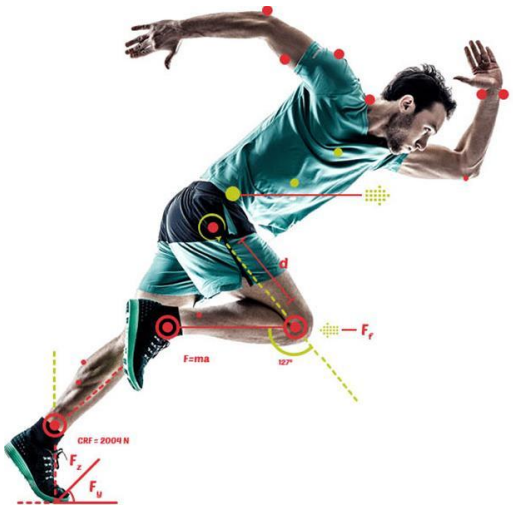
Introduction

If it's the Olympics, the FIFA world cup, the Boston Bruins, or even your local high school sports games, sports are everywhere and enjoyed by billions of people. Who doesn't love a good game? Whether you're in the crowd, on your couch, or even one of the players, you can feel the sense of community and joy. But did you know that there's actually a strong relationship between Sports and STEM?

The relationship between STEM and Sports covers a wide variety of topics. It relates to diet and nutrition, biological aspects such as anatomy and physiology, the physics of different sporting activities, data and statistics to measure performance, psychology, and biomechanics. Having a well-balanced diet is essential for everyone, as it can increase your health and wellbeing. The emphasis on a healthy diet is even greater for athletes, as their performance and job rely on the health and performance of their bodies. Different athletes have different diets, and sometimes need to eat more than the average person due to the extended periods of time that they train. Athletes need carbohydrates for fuel as it can delay fatigue as well as allows them to compete at higher levels for longer. They also need a large amount of protein as it can repair and strengthen muscle tissue. Fat is also essential in the diet, as it can also act as fuel, as it is stored energy.

Another aspect that relates to sports and science is physiology. Sports Physiology is a branch of physiology, and it is the study of how exercise alters the structure and function of the body. Sports Physiologists need to have an in-depth understanding of the complex interactions of the body's biological systems when exercising, resting, extensive training, and injury. Physiology is a

sub-discipline of biology, and the next field we will talk about is Biomechanics, which is a branch of Biophysics. Biomechanics is the science of the movement of a body. This includes how muscles, bones, ligaments, and tendons all work together to produce movement. It can help with calculating the most efficient or least harmful movement in sports.



The last major topic is Physics! Physics is an essential branch of science that is needed to understand more about the techniques used in sports and why things happen the way they do. There are two very important concepts in physics that play an equally important role in sports: work and energy. Energy is a word you are probably very familiar with, and work can be defined as the energy transferred to or from an object through the product of force and distance. When thinking about the different forms of energy and its transfer in sport, you can think of the transfer of potential energy to kinetic energy when you drop a ball, the transfer of chemical energy into kinetic energy in the body when athletes run, and trying to transfer as much kinetic energy you can when you throw balls or hit them with baseballs or rackets.

There are many other different ways sports relate to STEM, whether it is collecting data and analyzing it to support athletes and help them quantify their skills and techniques, or even sports psychology that looks into the performance and wellbeing of athletes. STEM is everywhere and can help us learn so much more about the things that we love.

Northeastern Connections

Faculty Connection

This week's faculty connection is Dr. Christen Chiesa, PT, DPT, a resident in the Massachusetts General Hospital / Northeastern University Department of Physical Therapy, Movement, and Rehabilitation Sciences Sports Physical Therapy Residency Program. Dr. Christen played on the varsity women's soccer team through her undergraduate degree at Central Michigan University, then later earned her degree as a Doctor of Physical Therapy at the University of Pittsburgh.

The goal of the Sports Physical Therapy Residency Program is to give sports physical therapists the opportunity to improve their clinical skills while demonstrating a commitment to patients, students, and athletes. This program allows its residents to be part of an interprofessional health care system while working with recreational, high school, collegiate, and professional athletes. Dr. Christen believes that her past sport participation has given her a unique insight into the physical, psychological, and situational stressors that must be addressed when rehabilitating an athlete. Dr. Christen's clinical interests are in concussion management, adaptive sports, and ACL rehabilitation.

Student Connection

This week's student connection is Drew Montigny, a second-year Behavioral Neuroscience student on the pre-medical track at Northeastern University. Throughout high school, Drew played football and lacrosse, and continued his passion when he came to Northeastern. Drew has been a FOGO (Face Off Get Off) on the Men's Club Lacrosse team at Northeastern for two years now.

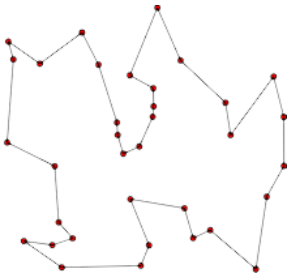
The Northeastern Men's Club Lacrosse team is a program that allows students to compete in lacrosse on a national scale without the overwhelming pressure and time commitment of a DI NCAA lacrosse program. The Men's Club Lacrosse team typically trains three times a week for

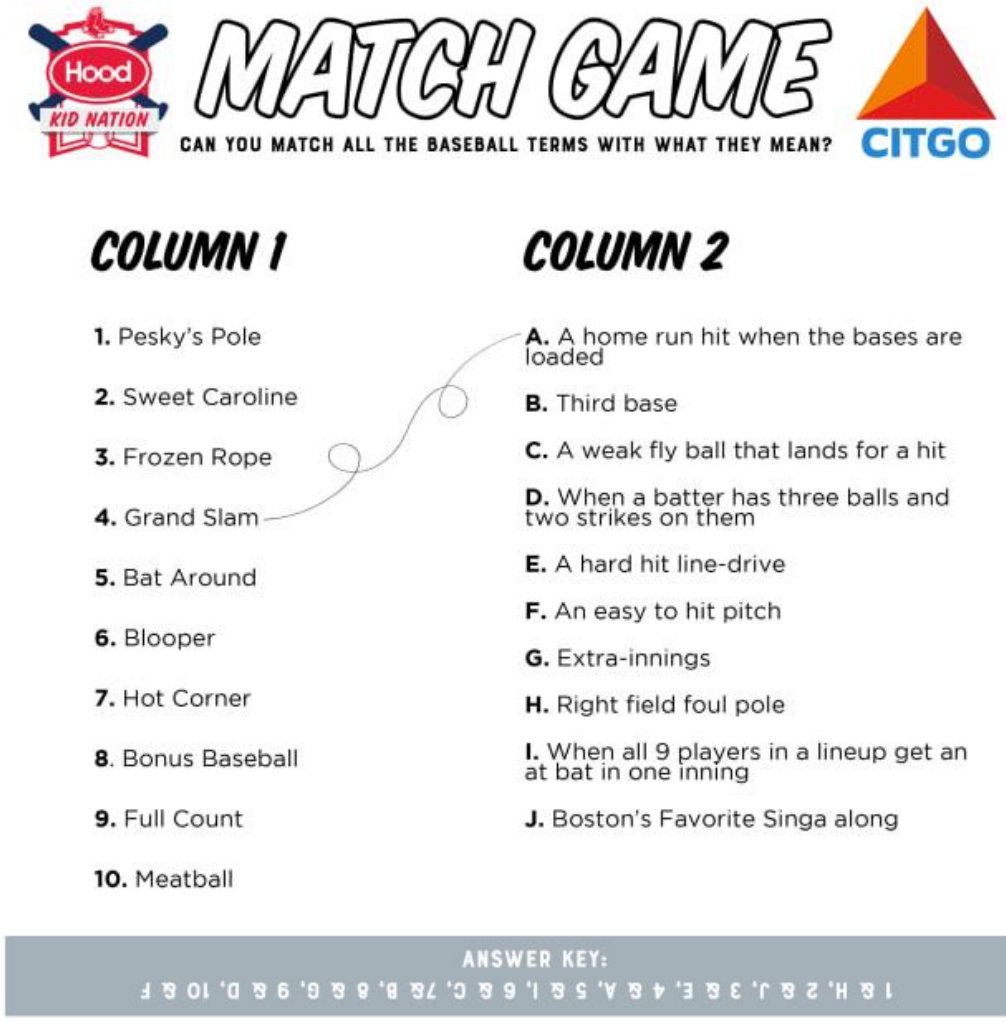
two hours and travels for games and tournaments. As a pre-medical student with his EMT license, Drew has the role of Health Officer on the team, meaning that he has the responsibility to provide first aid if ever needed at practice. Drew is particularly fond of the 40-person team and stated that this opportunity allows for good connections, and promotes an active lifestyle with a good diet throughout college.

Do Now

For this "Do Now", try to get more familiar with the sports teams based in Boston! See how many you can remember and write them down. Then research what they're called and see how many you were able to remember correctly.

The second part of this activity is brought to you by the Red Sox!





Activity

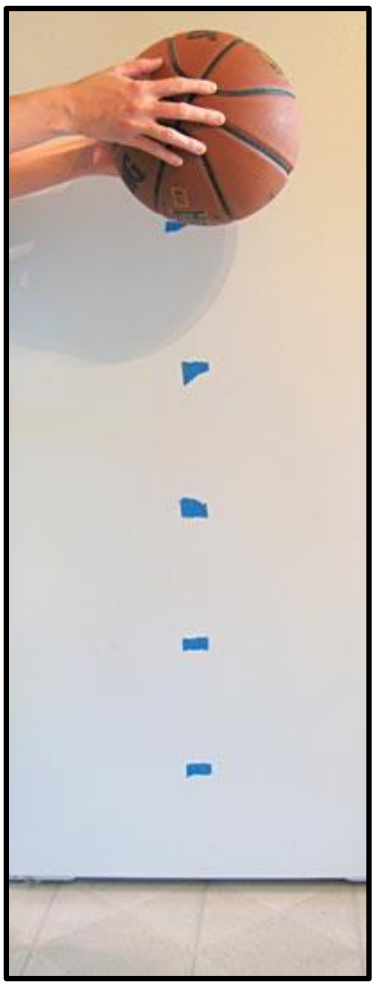
For this activity, we'll be studying the action of a simple basketball dribble in more depth. Why do basketballs dribble? What surfaces allow it to bounce the highest? This is going to be a physics experiment that relates to the mechanics of basketball and dribbling.
Source

Materials Needed:

You can use any materials you want but here are some suggestions:

- Different surfaces to bounce a basketball on (at least 3). The surface needs to be flat and next to a wall. Pick a variety of surfaces (different hardness, some soft, some hard)
- Tape measure
- Tape
- Video camera (a phone camera works fine)
- Basketball
- Microcomputer
- Index card
- Notebook

Steps:



- On the wall next to your surface, put some tape in 20cm intervals until you hit the 100cm mark (make sure you use tape that won't damage your wall!)
- Set up your camera in a sturdy location, make sure it captures all the tapes and the ground
- Start recording a video (record it in slow motion if you can). Write the trial number on an index card and show it to the camera. This will help you differentiate between the videos.
- Hold your basketball above the highest piece of tape (as shown in the image on the right)
- Release the basketball and let it bounce several times (hits the ground at least twice), then pick it up and stop the recording.
- Repeat this at least two more times on this particular surface, using a different trial number each time. After that, repeat all the steps above on different surfaces.
- Once you're done recording all the bounces, record your results in a table similar to the one below. You can find out the values by watching the videos you recorded and pausing at the right moments (play the video at a slower speed). The drop height is the height you initially released the ball at, the bounce height is the height it reached after the first bounce, and the difference is the difference between those two (the find the average of that difference for the three trials per surface)
- You can make a graph using your results! Make a bar chart of the average height per surface.

	Surface	Hardness	Drop Height (cm)	Bounce Height (cm)	Height Difference (cm)	Average Height
Trial 1	Surface 1					
Trial 2	Surface 1					
Trial 3	Surface 1					
Trial 1	Surface 2					
Trial 2	Surface 2					
Trial 3	Surface 2					
Trial 1	Surface 3					
Trial 2	Surface 3					
Trial 3	Surface 3					

Discussion Questions:

- Which surface allowed the ball to bounce the highest? Why do you think that happened?
- Describe the energy transfers that occur from the moment you release the ball to when you catch it again.
- Why does a basketball court use the material that it currently does?

Share Your Results

We'd love to know how the activity and/or the "do now" turned out! What worked and what didn't work? Please share with us something you learned and/or send us pictures! Email us at stem@northeastern.edu.

Related links/Extensions

- Virtual STEM Education Series: STEM Education Days | Boston Red Sox
- The science of sport.
- Sporting performance and food
- Physiology - EIS.