PLAY IMPOSSIBLE

Overview

For teachers, parents and students looking for new STEM learning opportunities, Play Impossible combines physical play, sensor technology and creative thinking apps for use at home and in the classroom. Studies such as John Ratey's *Spark*, (http://tedxmanhattanbeach.com/past-events/october-2012-conference-journey-to-purpose/presenters/john-ratey/) have shown that movement and exercise improve the brain's capacity to learn more efficiently. Yet, most classrooms today look and operate the same as they did in the 19th century with students forced to sit still through boring and abstract lectures on science and math. The company's first product, the Play Impossible GameballTM, is an active STEM system that delivers fun and challenging games integrated with math and physics lesson plans through a professionally crafted ball containing sensors that connect to a smartphone, tablet or Windows 10 PC via Bluetooth that helps teachers upgrade student learning opportunities and necessary skills for the 21st century.

The award-winning Gameball brings the digital action both indoors and outdoors though a free, connected app that delivers a variety of ball games and STEM lesson plans best suited for grades 4-8 and providing different ways to play with the Gameball to collect and examine physics data. Play with the Gameball for simple competitions, fun or integrate it into science lesson plans throughout the school year. More than 'just a ball,' the inflatable Gameball helps students learn kinesthetically via patented sensor technology that connects to the free Play Impossible app via Bluetooth, bringing a new STEM twist to a favorite play object. When the Gameball runs low on energy, refuel in 20 seconds with the Rapid Charger for another complete hour of fun! Play Impossible GameballTM is available at Apple stories, Amazon, PlayImpossible.com and coming to Microsoft Stores in June 2019 for $99.

Play Impossible Sport Labs and exploring Newtonian Physics with Fun

The Gameball comes loaded with games with challenges that encourage movement, creative thinking and problem solving. Using one of the featured games *Sport Labs*, students in grades 4-8 can develop both a kinesthetic and analytical understanding of fundamental physics principles while playing with a ball. Teachers, parents and kids can decide to play with these topics within the Play Impossible Windows 10 app that will walk you through every activity or advanced users can use in conjunction with Office 365 Excel using Data Streamer on Windows 10 PC's.

● **Newton's First Law**: Experience Newton's first law of motion explaining objects in motion in a fun (and less messy) take on the waiter pulling the tablecloth from under a plate or glass of water experiment. Using the Gameball and a piece of paper, pull the paper fast enough moving the ball as little as possible. The object at rest above the paper will stay in place demonstrating the interaction of inertia, force and friction. The team of students whose Gameball rotates the least win!

Note: to use the Newton's 1st Law activity with Office 365 Excel on Windows 10 you must subscribe to the Office Insider program (https://insider.office.com/en-us/).

● **Newton's Second Law:** The Digital Egg Toss game is a modern digital twist on determining force mass and acceleration. The physics lab favorite is now a real-time graphed experiment in Microsoft Excel requiring students to also make strategic decisions and calculate risk while learning the physics behind Newton's 2nd Law and without the clean-up required. The team with the lowest Newtons on their combined score of three tosses wins!

Note: Newton's 2nd Law activity is available for all Windows 10 Office 365 Excel. Find the README and links to lesson plans below in the downloads section.

● **Newton's Third Law**: Experiment with rules of equal and opposite reaction in Newton's third law of motion dropping the Gameball from different heights and measuring the first bounce, both for height and time in the air. Kids will see that based on high how the ball is dropped affects the equal and opposite reaction of the initial bounce. The team who can best predict bounce height and airtime win!

Note: to use the Newton's 3rd Law activity with Office 365 Excel on Windows 10 you must subscribe to the Office Insider (https://insider.office.com/en-us/) program.

Newton's First Law: Play Impossible Academic Explanation

Using the Play Impossible Gameball to exemplify Newton's First Law of motion is a fun and mess-free way to show that an object will stay at rest unless an outside force act upon it. Usually the stuff of viral videos, now students can see their efforts in a real-time graphed experiment in Excel or within the Play Impossible Windows 10 app via CSV export.

Newton's First Law activity: Paper Pull Formula Description When the ball is at rest the vector created by gravity is pointing directly at the center of earth. Once the paper has been pulled and the ball comes to rest again, we have a new slightly different vector pointing in the direction of gravity. Play. Impossible uses this formula to determine the angle between these

two vectors or the degrees that the ball has rotated.

The sensorized Play Impossible Gameball may also be connected to Excel using a Windows 10 application that connects to the Data Streamer Add-In. This allows you to extend the activity by encouraging data science activities using Excel. The Live Data graph on the Excel dashboard shows the movement of the Gameball when the paper or cloth is pulled out from under it. We are measuring the degrees rotated of the Gameball when the paper is pulled from beneath the ball. As students experience the motion of the of the ball when enacting a change to it, they can now visualize a real-time graph of it in Excel.

Using this activity, students can develop both a kinesthetic and analytical understanding of a fundamental physics principle while playing with a ball.

Use in other contexts

This activity can be used to provide a physical explanation for the following scenarios:

- A ball rolling on a floor until friction stops it, or it hits an object like a wall
- Why a person keeps moving forward in an accident when the car hits an immovable object like a wall

Supporting Next Gen Science Standards for Newton's 1st law with Play Impossible

MS-PS2-2
(https://www.nextgenscience.org/pe/ms-ps2-2-motion-and-stability-forces-and-interactions)

Plan an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object. [Clarification Statement: Emphasis is on balanced (Newton's First Law) and unbalanced forces in a system, qualitative comparisons of forces, mass and changes in motion (Newton's Second Law), frame of reference, and specification of units.] [Assessment Boundary: Assessment is limited to forces and changes in motion in one-dimension in an inertial reference frame and to change in one variable at a time. Assessment does not include the use of trigonometry.]

Science and engineering
practices

Planning and Carrying Out
Investigations

Planning and carrying out investigations to answer questions or test solutions to problems in 6–8 builds on K–5 experiences and progresses to include investigations that use multiple variables and provide evidence to support explanations or design solutions.

Plan an investigation individually and collaboratively, and in the design: identify independent and dependent variables and controls, what tools are needed to do the gathering, how measurements will be recorded, and how many data are needed to support a claim. (MS-PS2-2)

Related concepts

Stability and Change Explanations of stability and change in natural or designed systems can be constructed by examining the changes over time and forces at different scales. (MS-PS2-2)

Connections to nature of science

Scientific Knowledge is Based on Empirical Evidence Science knowledge is based upon logical and conceptual connections between evidence and explanations. (MS-PS2-2),(MS-PS2-4)

Newton’s Second Law: Play Impossible Academic Explanation

The Digital Egg Toss game is a modern digital twist on the egg toss. The physics lab favorite is now a real-time graphed experiment in Excel requiring students to also make strategic decisions and calculate risk while learning the physics behind Newton’s 2nd Law.

Newton's Second Law: Soft Catch Formula Description and Assumptions The Play Impossible physics engine is determining exactly when the catch is made, and then captures the peak common acceleration. Once gravity is removed, this formula is used along with the constant mass of the Gameball to determine the force/Newtons of each catch.
Using this activity, students can develop both a kinesthetic and analytical understanding of a fundamental physics principle while playing with a ball.

Use in other contexts

This activity can be used to provide a physical explanation for the following scenarios:

- To digitally practice the classic egg drop experiment before conducting it with eggs
- To kinesthetically replicate the deceleration for an astronaut returning from space capsule
- Catching a ball properly in a sport like a goalie in soccer, an American football wide receiver, a fielder catching a ball in cricket

Supporting Next Gen Science Standards for Newton's 2nd law via Play Impossible

MS-PS2-2
(https://www.nextgenscience.org/pe/ms-ps2-2-motion-and-stability-forces-and-interactions)

Plan an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object. [Clarification Statement: Emphasis is on balanced (Newton's First Law) and unbalanced forces in a system, qualitative comparisons of forces, mass and changes in motion (Newton's Second Law), frame of reference, and specification of units.] [Assessment Boundary: Assessment is limited to forces and changes in motion in one-dimension in an inertial reference frame and to change in one variable at a time. Assessment does not include the use of trigonometry.] Science and engineering practices

Planning and Carrying Out Investigations Planning and carrying out investigations to answer questions or test solutions to problems in 6–8 builds on K–5 experiences and progresses to include investigations that use multiple variables and provide evidence to support explanations or design solutions.

Plan an investigation individually and collaboratively, and in the design: identify independent and dependent variables and controls, what tools are needed to do the gathering, how measurements will be recorded, and how many data are needed to support a claim. (MS-PS2-2)

Crosscutting concepts

Stability and Change Explanations of stability and change in natural or designed systems can be constructed by examining the changes over time and forces at different scales. (MS-PS2-2)

Connections to Nature of science

Scientific Knowledge is Based on Empirical Evidence Science knowledge is based upon logical and conceptual connections between evidence and explanations. (MS-PS2-2),(MS-PS2-4)

Newton's Third Law: Play Impossible Academic Explanation

Using the Play Impossible Gameball to exemplify Newton's Third Law of motion is a unique and creative use of technology to show that for every action upon an object there is an equal and opposite reaction in the opposite direction by the other object. In this experiment the second object will be a stationary floor and they will see the force enacted upon the ball based on how high they drop the ball from. Students can see their efforts in a real-time graphed experiment in Excel or within the Play Impossible app for later export.

Newton's Third Law: Ball Drop Description and Assumptions The Play Impossible physics engine determines the airtime for each drop and bounce. Each higher drop should result in a longer airtime on the following bounce. This formula gives us the height of each bounce using gravity and the measured time of the bounce.
Using this activity, students can develop both a kinesthetic and analytical understanding of a fundamental physics principle while playing with a ball.

Players will also learn the concepts of friction and air resistance, and more importantly compression, and gravity as the ball with drop from 1G exerted on it, but its equal and opposite reaction will also be impacted by gravity. Of course, the ball will not bounce back to the spot where it was dropped, despite an equal reaction being exerted on it when it bounces.

Use in other contexts

This activity can be used to provide a physical explanation for the following scenarios:

- How jumping off a diving board sends you into the air for a better dive
- When air rushes out of a balloon, the opposite reaction is the balloon flying up and away

Supporting Next Gen Science Standards for Newton's Third Law with Play Impossible

MS-PS2-1
(https://www.nextgenscience.org/pe/ms-ps2-1-motion-and-stability-forces-and-interactions)

Apply Newton's Third Law to design a solution to a problem involving motion of two colliding objects* [Clarification Statement: Examples of practical problems could include the impact of collisions between two cars, between a car and stationary objects, and between a meteor and a space vehicle.] [Assessment Boundary: Assessment is limited to vertical or horizontal interactions in one dimension.]

Constructing Explanations and Designing Solutions Constructing explanations and designing solutions in 6-8 builds on K-5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories.

Apply Scientific ideas or principles to design an object, tool, process or system.

Disciplinary Core Ideas For any pair of interacting objects, the force exerted by the first obj act on the second object is equal in strength to the force that the second object exerts on the first, but in the opposite direction.

Crosscutting concepts

Systems and System Models Models can be used to represent systems and their interactions - such as inputs, processes and outputs - and energy and matter flows within systems.

Connections to Engineering, Technology, and Applications of Science The uses of technology and any limitations on their use are driven by individual or societal needs, desires and values; by the findings of scientific research; and by differences in such factors as climate, natural resources, and economic conditions.

Downloads

README & Lesson Plans
(https://www.playimpossible.com/education/data_streamer.pdf)

Play Impossible Windows App
(https://www.microsoft.com/en-us/p/play-impossible/9p6xxx4nlvcp)

Support

Please contact support@playimpossible.com with any questions, suggestions or feedback.