Health Smart Virginia – STEM in the GYM

Grade Level: 5

Note: This lesson is more directly geared to Grade 5 based on the Physical Education curriculum. However grades 1-4 can participate and be successful. This lesson offers an opportunity for cross-curriculum activities specifically geared toward grade 3 & 4 science SOLs.

Unit **STEM in the GYM**

SOLs:

Physical Education SOLs

1.1.h: Demonstrate forward, sideways, backwards (slow), and side-to-side directions.
1.1.i: Demonstrate low, medium, and high levels.
1.1.j: Demonstrate straight, curving, and zigzagging pathways
2.1.f: Demonstrate manipulative skills using increased force (hard) and decreased force (soft) with control.
3.2a: Apply the concept of open space while moving.
4.2.f: Identify the concept of closing space during movement sequences.
5.1.d: Demonstrate use of space in a variety of activities.
5.1.e: Demonstrate accuracy in a variety of activities.
5.1.f: Demonstrate use of force in a variety of activities
5.1.g: Apply concepts of direction and force to strike an object with purpose and accuracy.
5.2.c: Describe concepts of direction and force used to strike an object with purpose and accuracy.

Science SOLS

1.2 The student will investigate and understand that moving objects exhibit different kinds of motion. Key concepts include

a) objects may have straight, circular, and back-and-forth motions;
b) objects may vibrate and produce sound; and
c) pushes or pulls can change the movement of an object.

3.2 The student will investigate and understand simple machines and their uses. Key concepts include

a) purpose and function of simple machines;
b) types of simple machines;

c) compound machines; and
d) examples of simple and compound machines found in the school, home, and work environments.

4.2 The student will investigate and understand characteristics and interactions of moving objects. Key concepts include
a) motion is described by an object's direction and speed;
b) changes in motion are related to force and mass;
c) friction is a force that opposes motion; and
d) moving objects have kinetic energy.

Title: STEM in the GYM event

Objectives/ Goals:

- Student will be able to identify many simple machines (grades 1-2)
- Student will be able to explain several simple machines (grades 3-5)
- Student will be able to demonstrate use of force and movement pathways in station based activities (grades 1-2)
- Student will be able to demonstrate and explain force and movement pathways through station based activities and assessment (grades 3-5)

Materials:

- Equipment needs are listed under each station for quick reference.
- **Special Note:** Some of the equipment used in this lesson was purchased through a grant. The grant was very helpful but not required. Many of the station equipment can be modified from pre-existing equipment, made or omitted altogether.

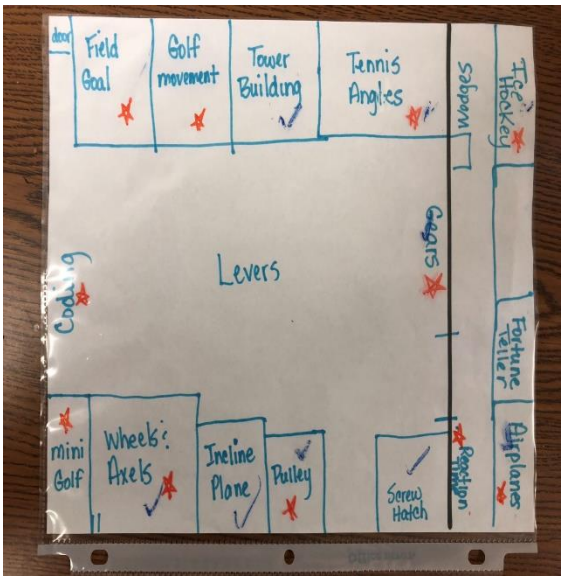
Procedure:

Special Note: This lesson is designed as a STEM in the Gym day. This is a summative event where all

these stations are introduced over time before the event. Therefore the lead up lessons introduce these concepts ahead of time and this is the culminating event. I introduced 2 stations a day for 5minutes before recess leading up to the event. However, these stations can be broken down and stretched over a 4-5 lessons with greater emphasis on different stations. These stations can be used during recess activities or to supplement an already existing lesson. The sky is truly the limit.

- Students enter the gym. Teacher gives a quick introduction and reminder of what each station is and what they are working on.
- Each station will have a staff member or volunteer monitoring it.
    - Special Note: Can also have 5th graders lead the stations for lower graders to better reinforce the STEM concepts with them.
- After instructions are given students will be called by pre-established groupings to get up and go to the station of their choice. Students then rotate to the stations of their choice when they complete a station with the encouragement to try every station at least once.
- Volunteers are instructed to encourage students to move on if they have been at a station for a while.
- Allowing students to choose provides a student voice and choice component.
- At each station students must first read the poster, then they can participate in the activity. After the activity the volunteer or staff member will ask the student questions about the poster and the activity. For example with wheels and axels station "what is an example of a wheel and axel?" Answer could be a bicycle or car. Then the volunteer could ask "what's an example of a wheel and axel in sports?" the student would be able to respond bike riding or even something like racing.

Concept: Several stations will be setup around the gym. Each focused on a STEM concept tied to some kind of motor movement (Kinesthetic learning). Each station will have a staff member or volunteer at it. Those staff members or volunteers would have knowledge of the realm that the STEM concept entailed.



Setup: Each station should have 1 volunteer (Preferably someone who knows about the content) and at least 1 poster describing the practical application of the station. For example Screw Hatch's poster will explain how screw

hatches work but also include places it is used such as submarine hatches.

Timeframe: Each grade level will have approximately 45 minutes to explore and visit the STEM concepts of their choosing.

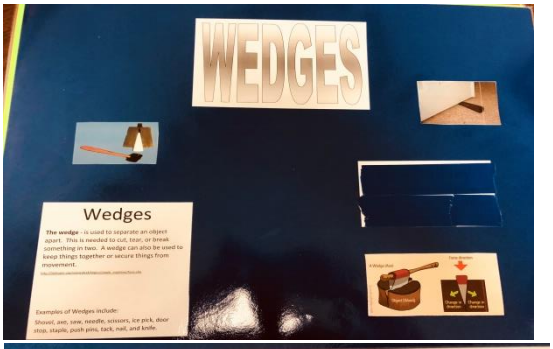
Stations

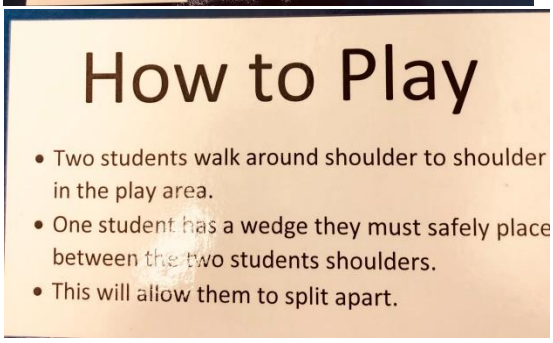
Station 1: Wedges

Equipment: 8 cones, wedge tag blocks

Students learn how wedges help us separate or split things. Examples include our hands, knife, floor nail, Crowbar, and Chisel. Students will be paired up into groups of 2. The students must walk around shoulder to shoulder in the designated area.

Another student will hold the wedge-it. That student must place the wedge gently between the two students shoulders to represent a wedge being used to separate two objects. (Simple Machines, p.9)

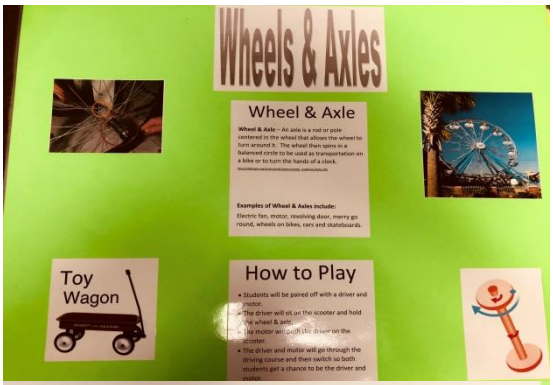


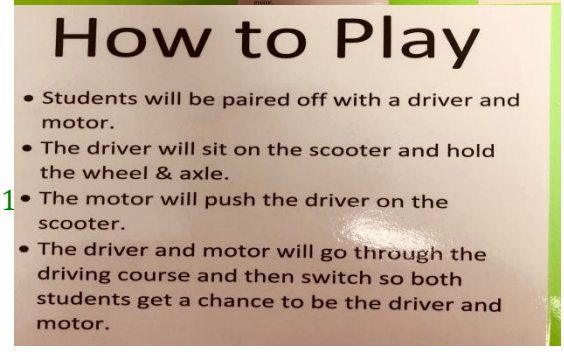


Station 2: Wheels and Axles

Equipment: 4 scooters, lay out a course with cones (approximately 10-20), 4 wheel and axels

Students will learn about wheels and axles. Students will kinesthetically experience the mechanical advantage using a wheel and axel. Students will be paired off with a driver and motor. The driver will sit on the scooter holding the wheel and axel on the ground. The motor pushes safely the scooter and





driver around the designated cone and back. The driver can steer using the wheel and axel. After one turn switch so the motor gets a chance to drive. (Simple Machines, p.17)

Station 3: Pulley

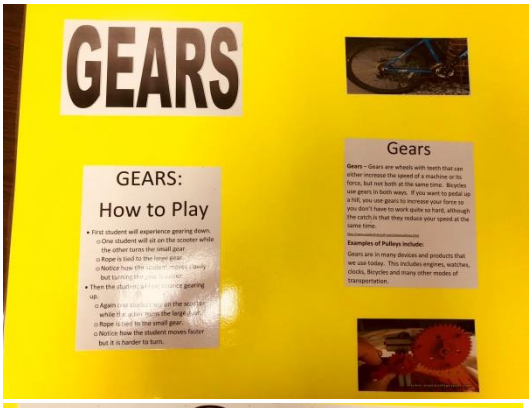
Equipment: Pull up bars (2), 4 clamps, 4 pulley systems, 4 scooters, 1 line cone, floor tape

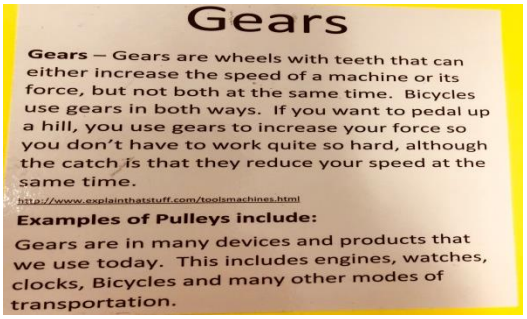
Students will learn about pulley systems. Students will learn the mechanical advantage of using a pulley. Students will first attempt to move themselves from marked starting line to finish line on the scooter using only their hands (may lay on their bellies on the scooter). Then student will try to move from starting line to finish line using the Pulley. For the pulley have one student hold the slack on the rope while the other on the scooter uses the pulley. (Simple Machines, p.12)

Station 4: Gears

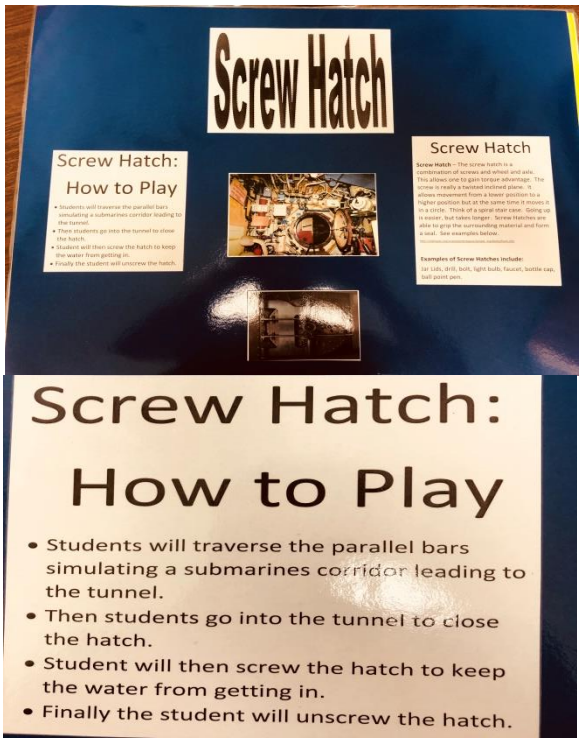
Equipment: 4 Gear mechanisms, 4 scooters, 4 line cones

Students will kinesthetically experience the mechanical advantage of using gears individually, with built-in pulley, and with wheel and axle (Scooter). Students will experience gearing down and gearing up. Students may notice that the scooter will travel slower during gearing down, but the effort will be easier. Students may notice during gearing up the scooter travels faster but requires more effort. For gearing down rope is tied around the large gear. For gearing up rope is tied around the small gear. Once student will sit on the scooter while the other turns the gear for each setup to experience the difference in speed and effort required to move the gears and the scooter.(Simple Machines, P.21)



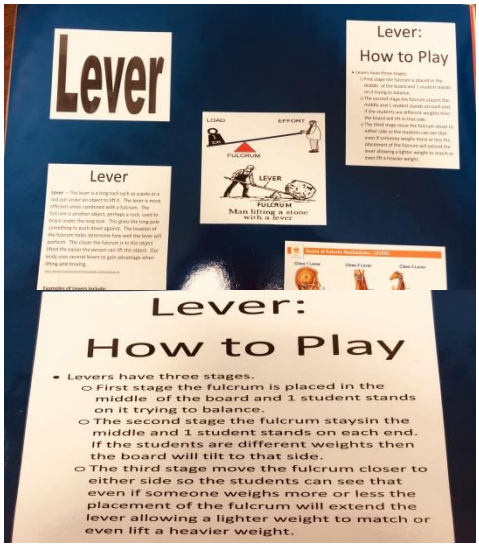


Station 5: Screw Hatch



Equipment: Parallel bars, couple mats, 1 line cone, 2 – 4 screw hatches

Students will kinesthetically experience the mechanical advantage of using a screw. Practical applications of a screw hatch are used on ships, cars, appliances and in numerous other areas and products. Students will turn the screw hatch to close it then unscrew it to open the hatch. Students can pretend they are on a submarine and need to close the hatch to keep water from entering the submarine. Students must get through a small obstacle course to shut the hatch by using the screw hatch. (Mats can be setup like a tunnel)

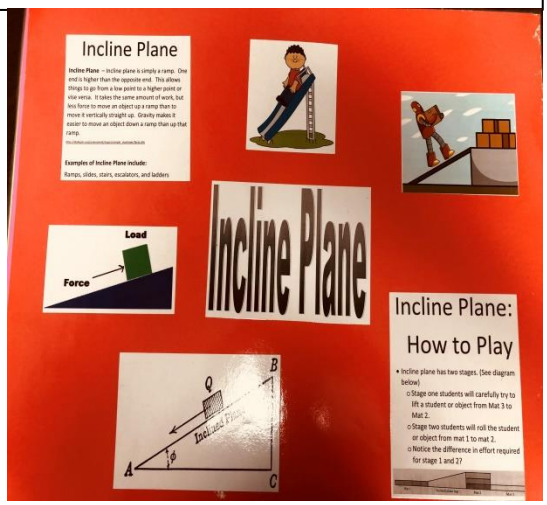


Station 6: Lever

Equipment: 1 line cone, 4 – 6 carpet squares, 4 – 6 lever and fulcrums

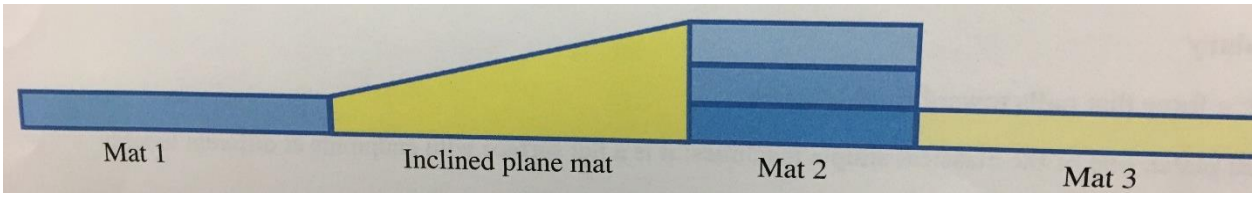
Students will kinesthetically experience the mechanical advantage of using a lever. Levers have two stages that can be done. First is to self-balance using the fulcrum in the middle. Then move the fulcrum to see how it effects the students balance. The second stage is to have two people one on each end of the lever with the fulcrum in the middle. As the fulcrum is moved can one student support more weight on the other side? *YES if moved the correct direction. (Simple Machines, P. 30)

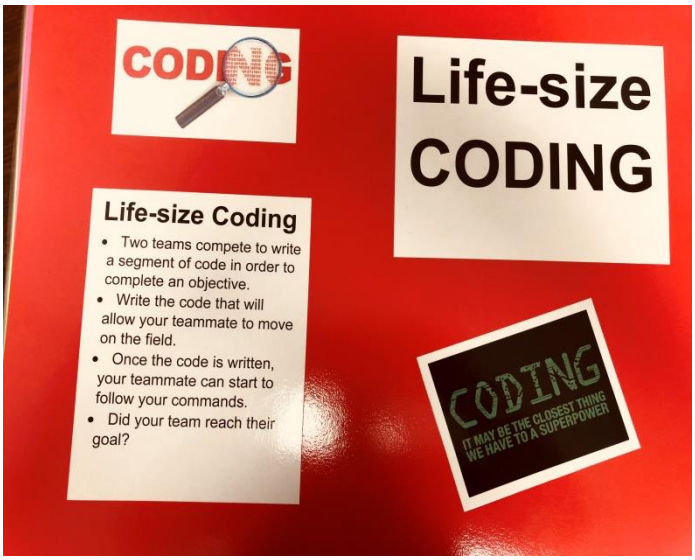
Station 7: Incline Plane



Equipment: 1 line cone, 1 wedge mat, 3 mats (double for 2 setups)

Students will kinesthetically experience the mechanical advantage of using an inclined plane. Mats will be set up as seen in the picture below. Students will safely lift a student or object from Mat 3 to Mat 2. Notice how difficult it was. Then students will attempt to roll a student or object from Mat 1 up the incline plane to Mat 2. It should be much easier this time due to the incline plan. (Simple Machines, P. 34)





Station 8: Coding

Equipment: Grid on floor (tape, poly spots, FloorMarx), obstacles, Code sheets, Tape

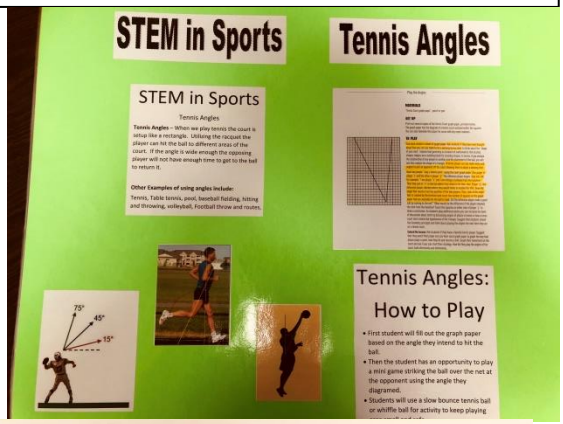
Codes: Add more as needed: Up, down, left, right, jump, 1, 2, 3, 4, 5

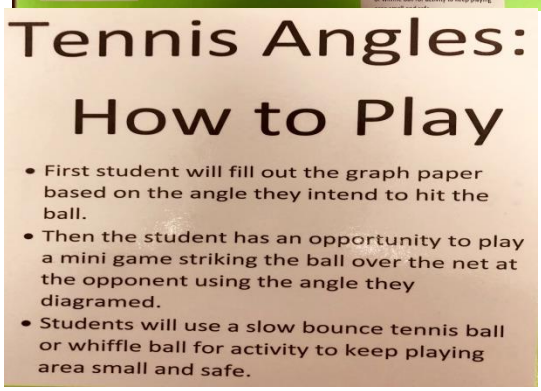
Students partner up and one student picks different code segments to put on the wall. When they do their partner does that code in the game grid. For example If they put right – 4 the partner would move to their right 4 spaces. Obstacles, traps and prizes can be placed in the grid to make it more interesting including jumping grids like having an obstacle can be jumped over so one player would put jump-2 for their partner to jump over the obstacle.

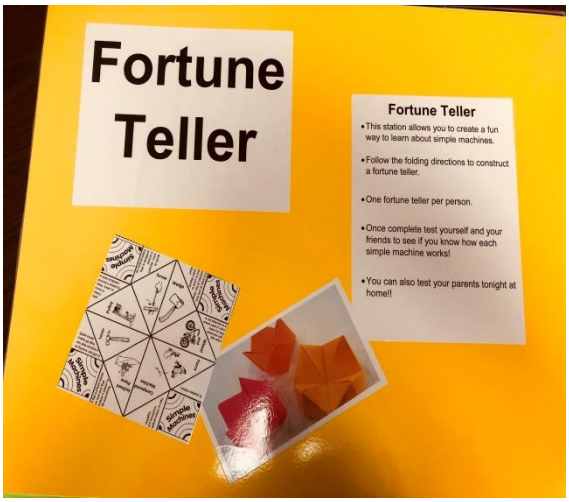
Station 9: STEM in Sports (Tennis Angles)

Equipment: 1 Line Cone, 2 tennis racquets, 1 slow bounce tennis ball, 2 standing mats, 1 net, pencils and grid paper of tennis court, Line Tape

Students will use grid paper to show the angle of a tennis strike based on the force and direction applied to the ball. Then they will have an opportunity to create their angle by hitting a slow bounce tennis ball with a racquet in the direction they drew out on the grid paper.







Station 10: STEM Craft project

Equipment: Folding paper with simple machine diagram

Students create a folding paper project with several STEM concept terms and their definitions. The fortune teller simple machine came from Pinterest: https://www.pinterest.com/pin/244812929717126507 . Others exist online that can be used. Preprinted several for students to create 1 each. We shrank the image to fit 2 fortune tellers on 1 page and cut them to save paper.

Station 11: Build mini Golf hole

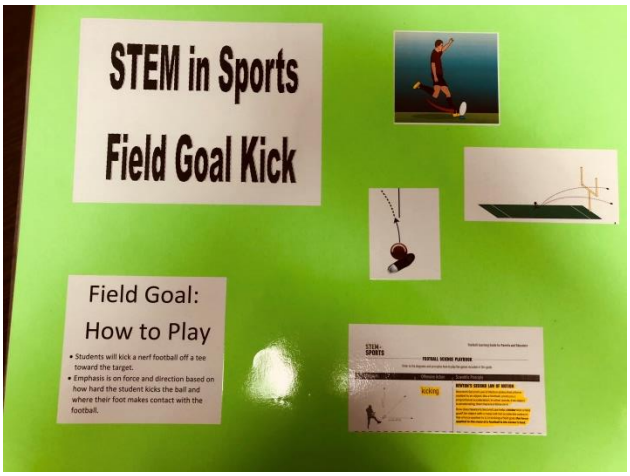
Equipment: Noodles, steps, 1 line cone, 2 putters, whiffle golf balls, putting holes, obstacles

Students will be given an assortment of equipment they can use to design their own putt putt course. After they create it, they can play on it once and then let another group design their putt putt course.

Station 12: Tower building

Equipment: Jumbo Cups, basic stacking cups

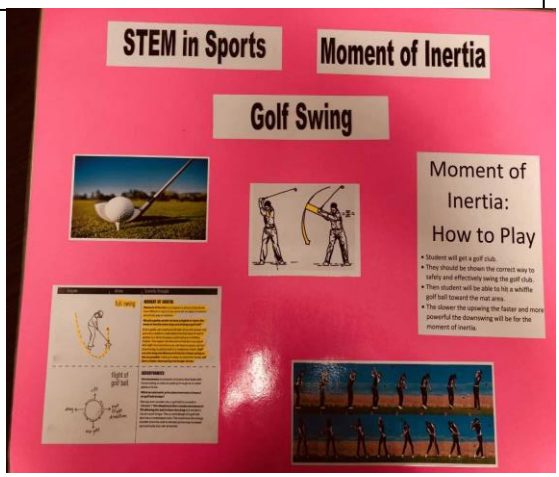
Students will use the jumbo cups to create buildings and structures that must be structurally sound. Safety and protection of the cups take high priority and students should not intentionally knock over the cups.



Station 13: STEM in Sports (Field Goal Kick)

Equipment: Kicking Tee (2), Nerf football (2), 1 Line Cone, Tetherball post (2), Standing Mats (2)

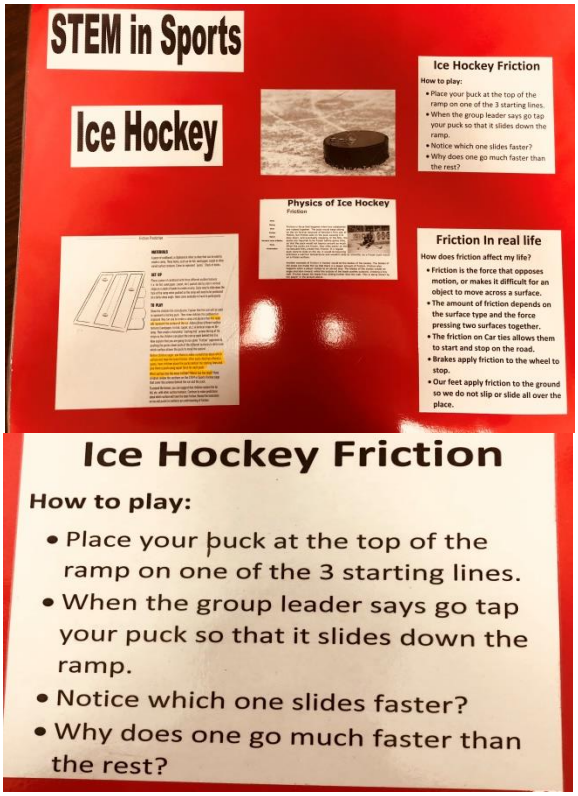
Students will learn about Newton's Second Law of Motion. Objects that are accelerating have a force on them. Therefore to send the football in the direction the kicker wants they must use their foot to apply force to a specific part of the football.



Station 14: STEM in Sports (Golf)

Equipment: Golf Club (2), Standing Mat (2), Whiffle Golf Balls, Tee on a mat or carpet square (to protect floor), 1 Line Cone

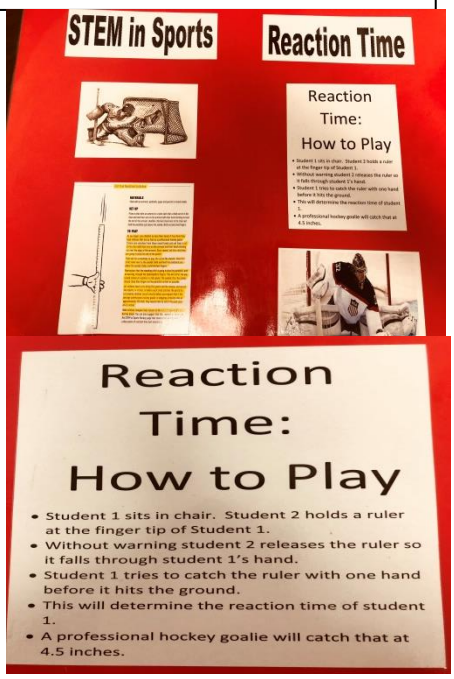
Students will learn about moment of inertia. Students will stand on the mat with a golf club and a whiffle golf ball. They will when safe strike the golf ball to send it flying toward a mat standing up. Golf nets, mats or whiffle golf balls can all be used to maintain additional safety parameters. Students will have the moment of inertia explained to them that in golf the lower the moment of inertia is at the start of the swing allows a greater and faster downswing creating more force on the ball and a longer drive.



Station 15: STEM in Sports (Hockey Surface) (Friction)

Equipment: Corn hole board, Hockey pucks (3), Tin foil, sand paper, Carpet, 1 Line Cone

Students will learn how friction effects playing surfaces in hockey and how this relates to other aspects of life effected by friction. Students will drop a hockey puck down 3 separate lanes. One lane will have tinfoil, one will have sandpaper and the last one will be another rough surface. Students will see and experience how rougher surfaces have the puck move down slower due to more friction.

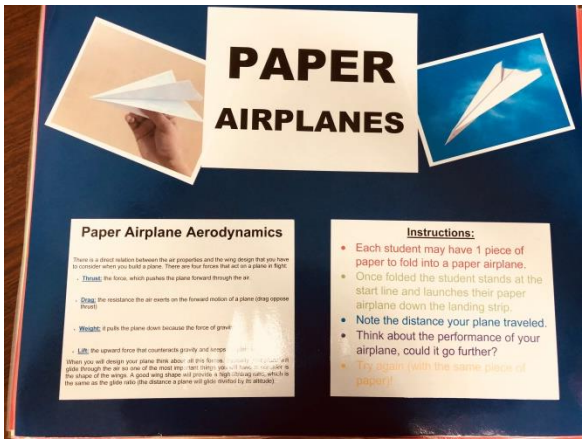


Station 16: STEM in Sports (Hockey goalie reflexes) (Reaction Time)

Equipment: 2 Chairs with arm rest, 2 Yard sticks

Students will learn how science and mathematics can be used to determine our own abilities in sports. For this activity one student will

sit in a chair while the other holds a yard stick with the end at the first student's finger tips. Without warning the second student will drop the yard stick and the first student must catch the yardstick as it falls through their hand. Wherever they stop it at is their reflex time.



Station 17: STEM Design aerodynamics

Equipment: Paper, Line Tape

Students will design their own paper airplane and test it to see if their design is effective. Setup a long runaway or wind tunnel. Measure out distances up to 20 feet if available. Allow each student to have 1 piece of paper to create and test their paper airplane design. Students may redesign their airplane as many times as they want however they must use that same piece of paper.

Station 18: Accuracy and force

Equipment: Pencils, rubber bands, cones, targets (poly spots, buckets, etc)

Students have a pencil and a rubber band. Strict instructions are provided ahead of time for safety and safe use. Student steps up to the "launch bay". From there the student will try to pull back their rubber band and launch it to a designated target. Different targets are placed on the floor at varying distances. First student must get it to land in target 1, then 2, etc. Targets can be poly spots, buckets or other objects. For safety either the volunteer has several students go at the same time then all go to get their rubber band at the same time, or have only 1 student go at a time. This can be determined by staff, equipment and space for safety.

Final Note: We teach STEM on an almost daily basis. STEM concepts can be introduced, reinforced or emphasized during all kinds of lessons from locomotor, throwing and catching and much more.

Assessments, References & Sources:

- Jones, C. M. (2011). *STEM in the GYm*. Pittsburg, KS: Pitsco. doi:https://www.pitsco.com/STEM-in-the-Gym/STEM-in-the-Gym-Simple-Machines-Teacher-Guide
- Fortune Teller Simple Machines: Pintrest - https://www.pinterest.com/pin/244812929717126507
- S&S Blog – STEM Activity Ideas for Phsical Education - http://www.ssww.com/blog/stem-steam-activity-ideas-physical-education/
- Pinterest – STEM activities - https://www.pinterest.com/annecross7/stem-ideas-for-pe/?lp=true
- Pitsco Education - https://www.pitsco.com/

Assessment: Written assessment is attached. Can also convert to plickers, or an exit ticket to check students learning.

Other assessment questions that may be appropriate for grades 3-5.

List 3 simple machines: _____ _____ _____

Name 1 activity that required force: _____

Name 1 activity that required accuracy: _____
Name 1 activity that required use of space: _____

Full Name_____ Teacher_____ Date _____

Simple Machines Post-Test

Read the sentence and **CIRCLE** the best answer.

1. What is a **Simple Machine?**
   a. A machine that is complex
   b. One of the basic machines that make up other machines by making work easier
   c. A machine that has an engine
   d. Equipment used in PE to put air into a ball

2. What is **STEM**?
   a. Sport Technology Education Moving
   b. part of a plant that holds the flower
   c. Science Technology Engineering Mathematics
   d. Science Teaching Education Methods

3. What is the mechanical advantage/reason of using a **wedge**?
   a. Used to separate two objects or portions of an object while using less force
   b. A potato fry that has wrinkles
   c. A weight of mass that is carried, lifted, moved, or supported
   d. To change the direction and intensity of a pulling force

4. What is a **pulley**?
   a. A scooter that you push
   b. The amount of energy exerted to perform a task
   c. A rigid bar pivoted on a fixed point (fulcrum) used to transmit force
   d. A machine (based on the wheel) used to change the direction/intensity of a pulling force

5. Pulling someone (with a **pulley**) on a scooter is easier than pulling a person not on a scooter (without a **pulley**). This is true for what reason:
   a. Because of more friction on a scooter
   b. There is more weight with a scooter
   c. Two simple machines being used (pulley and wheel & axle) makes it easier to move
   d. Gravity is pulling significantly more on the scooter

6. Which item in this list of PE equipment is NOT a **wheel and axle?**
    a. ball
    b. scooter
    c. cart
    d. volleyball standard

7. Which one of these has a **gear**?
    a. wheel barrel
    b. hockey stick
    c. golf putter
    d. bike

8. Which one of these is NOT a **screw**?
    a. screw hatch
    b. screw-on lid
    c. screw in scooter
    d. hockey stick

9. Which simple machine (**lever**) concept of a rigid bar pivoting on a fixed point (fulcrum) used to transmit force in volleyball?
    a. forearms bump pass
    b. set pass
    c. dig
    d. diamond shape hands

10. Circle the **lever** NOT used in PE**?**
    a. crow bar
    b. baseball bat
    c. hockey stick
    d. golf club

11. What force of nature makes it easier to roll down an **inclined plane** mat?
    a. coriolis effect
    b. gravity
    c. work
    d. plastic

12. Which one of these is NOT classified technically as one of the six **simple machine**?
    a. screw
    b. lever
    c. gear
    d. wheel and axle

STEM in the GYM Survey

Hallway Stations

3 = Great 2 = Ok 1 = Poor NA = Did not do Station

Circle how you felt about each station

Station: STEM Design aerodynamics

3 = Great 2 = Ok 1 = Poor NA = Did not do Station

Station: STEM Craft project

3 = Great 2 = Ok 1 = Poor NA = Did not do Station

Station: STEM in Sports (Hockey Surface) (Friction)

3 = Great 2 = Ok 1 = Poor NA = Did not do Station

Station: STEM in Sports (Hockey goalie reflexes) (Reaction Time)

3 = Great 2 = Ok 1 = Poor NA = Did not do Station

Gym Stations

3 = Great 2 = Ok 1 = Poor NA = Did not do Station

Circle how you felt about each station

Station: Wheels and Axles

3 = Great 2 = Ok 1 = Poor NA = Did not do Station

Station: Pulley

3 = Great 2 = Ok 1 = Poor NA = Did not do Station

Station: Gears

3 = Great 2 = Ok 1 = Poor NA = Did not do Station

Station: Screw Hatch

3 = Great 2 = Ok 1 = Poor NA = Did not do Station

Station: Lever

3 = Great 2 = Ok 1 = Poor NA = Did not do Station

Station: Incline Plane

3 = Great 2 = Ok 1 = Poor NA = Did not do Station

Station: Coding

3 = Great 2 = Ok 1 = Poor NA = Did not do Station

Station 9: STEM in Sports (Tennis Angles)

3 = Great 2 = Ok 1 = Poor NA = Did not do Station

Station: Build mini Golf hole

3 = Great 2 = Ok 1 = Poor NA = Did not do Station

Station: Tower building (Architecture)

3 = Great 2 = Ok 1 = Poor NA = Did not do Station

Station: STEM in Sports (Field Goal Kick)

3 = Great 2 = Ok 1 = Poor NA = Did not do Station

Station: STEM in Sports (Golf)

3 = Great 2 = Ok 1 = Poor NA = Did not do Station

What was your favorite station?	**What should we add next time?**	**What did you not like?**