UNIT TITLE: Simple Machines

SCIENCE COURSE OF STUDY
GRADES SECOND-FIFTH

Lessons: ***Wedge, Screw, and Inclined Plane***
Levers 1: Push/Pull duets
Levers 2: Lifting and Letting down
Levers 3: Counterbalancing
Pulley and Gears

WEDGE, SCREW, INCLINED PLANE

Students use bound and free energy to create a sequence made from predetermined movement.

Procedure:

1. The motion of these machines uses degrees of bound and free energy. First, students explore these two concepts using bound energy to create shaped and free energy to travel.
2. Each simple machine has its own movement.
   Screw spirals to the ground and back.
   Wedge slices from wide to narrow.
   Inclines plane cuts from high to low on the diagonal.

Ask students to practice each simple machine movement with you. Do each movement progressing from bound to free and then free to bound.

3. As a class, create a sequence using each movement and determining whether the movement will be bound to free or free to bound. Each movement can have its own progression or the whole sequence can move from free to bound or vice versa.
4. Students break up into duets, trios, or quarters and create their own sequence.

LEVERS 1: PUCH/PULL DUETS

Students explore negative and positive space with a partner

Procedure:

1. All force is in the form of a push or pull. This activity sensitizes students to push or pull force, but mostly, it serves as a transition to the lever and counterbalancing activities. Encourage students to create shapes with a variety of negative and positive space. How are they creating these shapes? With their joints! Ask students to identify the joints. For this class, I expect students to know 11 joints: skull to neck, jaw, spine, shoulders, elbows, wrists, fingers, hips, knees, ankles, toes: however, we only need 10 of them to dance.
2. Divide class into partners. Partner 1 will create a shape. Partner 2 will create a shape using partner1's negative space. Now, partner 1 creates a shape using the negative space of partner 2" shape. This can repeat many times to a variety of counts.
3. Partner one will sculpt partner 2 into a shape by using push or pull force at the joints. It is very important for partner 2 to use light touch and to clearly signal to partner 2

whether she/he is pulling or pushing. Partner 1 then gets in front of partner 2 and makes their exact shape. This can continue all the way across the room.

LEVERS 2: LIFTING AND LETTING DOWN

Student experiment with using the lever of the body to lift and lower.

Procedure:

1. If possible, precede this activity with a discussion around a skeleton. Have the students list all of the joints and notice what bones they connect. Bones do not move, muscles move us. All muscles act on a pull, muscles can not push. Joints are like levers, they help make work easier. Identify the force, fulcrum and load for the joints. (Fulcrum is the joint unless it is the heels against the floor, then the heels are the fulcrum. Force is muscular activity. Load is whatever bone is being moved) Ask students to stand and walk without moving their knees, hips, or ankles. Have students lock one joint and see if the other students can figure out which joint they locked.
2. Hold hands with a student and demonstrate the counter balance where both of you sink at the hips, knees, and ankles like you are about to sit in a chair but you are also counterbalancing with you partner. Ask students to try.
3. Remind students how to roll down softly lying with their backs on the floor. Grab hands with a student and demonstrate how to safely bring them to their feet by counterbalancing and creasing at the joints. This movement will serve a metaphor to understand how joints and levers make work easier; therefore, it will not work unless the person on the floor assists by using their muscles and levers too. Have students master picking up and putting each other down. (Very subtly partner up students of similar build.) Ask students to experiment with variations and record results in terms of difficulty or ease of work.
    a) Do not bend any joints
    b) Person lifting bends joints, but person on the floor doesn't. Vice versa.
    c) Remember that the heel acts as a level against the floor, so try varying the placement of the legs.
    d) Vary shape, grip, etc. What other elements could affect ease of work. Have students share results.
4. Have students create a highlight sequence they can repeat using the lifting and letting down variations that worked.

LEVERS 3:COUNTERBALANCING

Students extend their understanding of levers by counterbalancing.

Procedure:

1. Demonstrate the counterbalance of sitting in a chair. Add variations like one arm, sideways, hooking elbows. Allow students to improvise counterbalancing by offering a body part, counterbalancing, and then repeat the process by offering another body part. As always, encourage variety and unusual solutions. All of these counterbalances should by pulling away.
2. Demonstrate the opposite, and counterbalance of leaning into each other. Continue as above, but all of these improvised counterbalances should be pushes.
3. Allow students time to improvise a variety of pulling away and pushing in counterbalances. This works best if they do one pulling and then one pushing

counterbalance. Remind students that improvisation means making it up as you go, there are no right answers.

4. Ask students to create a sequence they can repeat using any pull away or pushing counterbalances and the any lifting or letting down variation. Things break down if students are not clear about what type of force they are using (push or pull) and if one student is acting as dead weight. Emphasis cooperation.
5. If some students are finishing faster, have them create new relationships with another duet. Now you will have duets and quartets.
6. Have students use any of the activities in the unit to create an entrance and exit.

GEARS AND PULLEYS (4TH AND 5TH)

A pattern performed in a circle is a metaphor for gears and pulleys.

Procedure:

1. Teach or create with the class a pattern in which interesting variations can be made about direction. I use
   With right hand, reach across the body to high diagonal
   Repeat with left
   With right hand, reach across the body to middle diagonal
   Repeat with left
   With right hand, reach across the body to low diagonal
   Repeat with left
   Reach both arms high roll down to the floor lying on back
   Roll back up
   Grapevine to right on quarter notes
   Grapevine to right double the speed
2. Use the pattern each session as a warm-up. First, I ask students to choose if we should start right or left. Sometimes I make events quicker or slower. You will have to teach the students how to roll down and get back up. Each day I go through a new variation. What happens if two people face each other. What hand do they need to start on to be the same? Opposite? What if we have an inside and outside circle? How can the circles move in unison during the grapevine? Opposite? When you have two circles moving in the same direction, you have a metaphor for the pulley. When you have two circles moving in opposite directions, you have a metaphor for gears. In groups of five or six, have the students use the pattern to demonstrate force moving in opposite or the same direction.