Station 1 Card: How Stable Am I?

PROBLEM STATEMENT: How does obesity affect your balance? In this experiment you will test the relationship between the center of gravity of an object and the base of support.

ACTIVITY BACKGROUND: In the game of football, why are the linemen important? Why are they normally the largest on the team? The job of a lineman is to protect the players behind him or get through the opposing line. It is important for the lineman to be able to maintain his balance as the opposing team tries to push past him. By lowering his center of gravity and expanding his base of support he is able to do his job. The lineman lowers his center of gravity by lowering his body. His base of support is wider because he is standing with feet wide apart. Think about it. Is it harder to knock someone over when they are standing with their feet together and straight up or feet spread apart and low to the ground? It is harder to knock someone over when their feet spread apart and they are low to the ground because their base of support is greater and their center of gravity is lower. Where weight is carried on an obese person determines where their center of gravity is located. In obese people the center of gravity has shifted because of the excess tissue (adipose) they carry. This results in a change in posture and possible back pain. In this experiment you will test the relationship between the ***center of gravity*** of an object and the ***base of support***.

Base of support – the part of the body that is touching the surface and the surrounding area.

Center of gravity – a geometric property of any object and the average concentration of the weight of that object.

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IDENTIFY VARIABLES IN THE EXPERIMENT: As directed on your student data page, write the independent variable and the dependent variable for this investigation and list some constants that would be important in controlling the experiment.

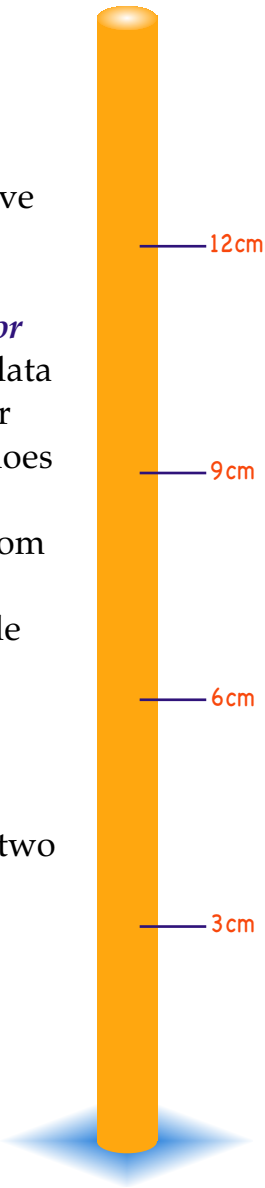
HYPOTHESIS: On your ***Student Data Page***, write a hypothesis based upon the background that predicts how the independent variable may affect the dependent variable. Be sure to write the hypothesis as an ***"if, then"*** statement.

ACTIVITY MATERIALS:

- 5/16" x 6" wooden dowel
- Clock or timer
- 2 Fender washers with a diameter of 5/16"
- Rubber band
- Marker
- Ruler
- 1 copy ***Student Data Page*** (per student)

PROCEDURE:

1. The reader reads all of the procedures to the group.
2. Stand the dowel vertically on the table. Try to balance it while holding it with your finger at the top of the dowel. Now remove your hand. The ***Test Subject*** will practice balancing the dowel before you begin recording the data.
3. The ***Test Subject*** will balance the dowel while the ***Data Collector*** times it, stopping the stopwatch when the dowel falls. In the data table the ***Recorder*** will record the number of seconds it took for the dowel to fall. Repeat this procedure 3 times. If the dowel does not balance at all, do not count the trial.
4. The wooden dowels are marked with lines 3, 6, 9, and 12cm from one end.
5. Stand the dowel upright with the 3 cm mark closest to the table and try balancing it again. Balance the dowel while the ***Data Collector*** times it until it falls as in step 3. In the data table the ***Recorder*** will record the number of seconds the dowel stayed balanced. Repeat three times as in step 3.
6. Wrap a rubber band around the dowel at the 3 cm mark. Add two washers on top of the rubber band. Repeat procedure 5.
7. Move the rubber band and washers to the 6cm mark. Repeat procedure 5.
8. Move the rubber band and washers to the 9cm mark. Repeat procedure 5.
9. Move the rubber band and washers to the 12cm mark. Repeat procedure 5.



Station 2 Card:
Carrying Weight Where?

PROBLEM STATEMENT: How does obesity affect your posture?

ACTIVITY BACKGROUND: A person's center of gravity is the location in the body where all the weight in the body is concentrated. The center of gravity shifts as the body changes position. Think of trying to perform a handstand. In order to stay balanced the center of gravity must stay between your base of support (your hands). The base of support is the part of the body that is touching the surface and the surrounding area. See *Figure 1*. If your center of gravity falls outside the base of support then you fall over. Imagine a line that runs directly through your center of gravity. This is called the line of gravity. See *Figure 2*. A person can maintain stability if the line of gravity falls within the base of support. The closer the line of gravity is to the center of the base of support, the more stable a person is.

Figure 1

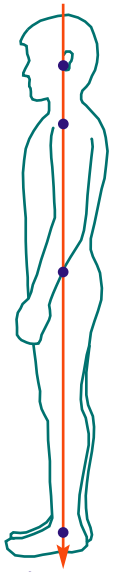


Figure 2

Figure 3

Obesity often affects a person's posture. Depending on where the weight is located on the person, it will change where the line of gravity falls in relation to the base of support. If the line of gravity doesn't fall in the correct location it will indicate an abnormal posture. In this activity, you will use a plumb line to experiment with how weight affects a person's posture. A plumb bob is a weight hung at the end of a string that points towards the earth's center of gravity. See F*igure 3 Plumb Bob*.

A plumb bob attached to a string creates a plumb line. A plumb line provides a vertical reference line and can be used to study person's posture. The plumb line allows us to determine where the line of gravity is on a person.

DESCRIPTION: In this activity you will be testing how weight affects a person's posture using a plumb line.

IDENTIFY VARIABLES IN THE EXPERIMENT: As directed on your *Student Data Page*, write the independent variable and the dependent variable for this investigation and list some constants that would be important in controlling the experiment.

HYPOTHESIS: On your ***Student Data Page***, write a hypothesis based upon the background that predicts how the independent variable may affect the dependent variable. Be sure to write the hypothesis as an "if, then" statement.

ACTIVITY MATERIALS:

- String
- Expandable shower curtain rod
- Ruler
- Books
- 1 Copy ***Student Data Page*** (per student)
- Plumb bob
- Round stickers
- 2 Back packs
- Meter Stick
- Doorway

PROCEDURE:

1. The reader will read the directions to the group and be sure everyone is following directions.
2. The test subject stands facing the doorframe so the plumb line is lined up with the test subject's side of the body. ***See Figure 4***.
3. The ***Data Collector*** will place stickers on the ***Test Subject*** according to ***Figure 4***. While placing the stickers on the test subject you must tell the test subject to stand up straight and still. Be sure his arms are at his side and he is looking straight ahead. You are locating the ***Test Subject's*** line of gravity.
4. Fill a back pack with books. Hand it to the test subject to wear on his back.
5. Check the line of gravity again. Using a ruler the ***Data Collector*** measures the distance from the sticker to the line of gravity at each point. ***The Recorde***r will record it on the data table.
6. Place the backpack in front of the ***Test Subject***. Help the ***Test Subject*** put the backpack on.
7. Repeat step 9.
8. Help the ***Test Subject*** put on the second backpack. The ***Test Subjec***t should be wearing a backpack in front and one in back.
9. Repeat step 9.

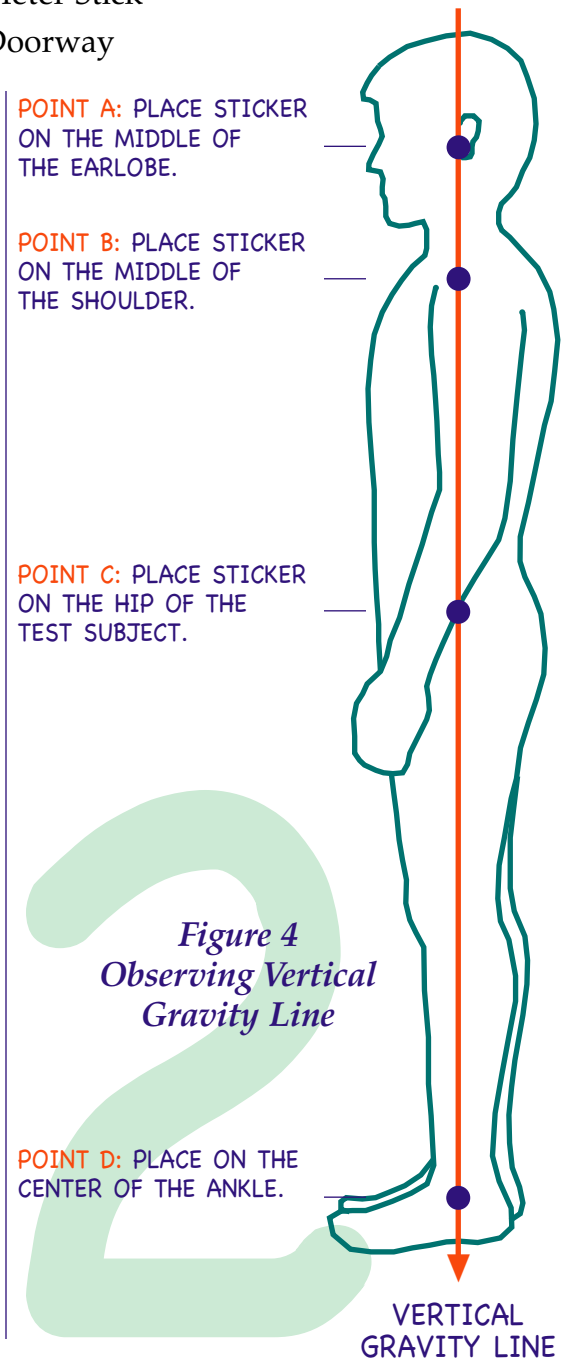


Figure 4
Observing Vertical Gravity Line

Station 3 Card: Measuring Range of Motion of Elbow Joint

PROBLEM STATEMENT: How does obesity affect your Range of Motion?

ACTIVITY BACKGROUND: The amount of motion a joint can perform is called range of motion (ROM). ROM is important for mobility. If the ROM of a joint is impaired it results in limited function and mobility. The instrument used to measure the ROM of a joint is called a goniometer. The term goniometry comes from the Greek words "gonia" meaning angle, and "metron" meaning measure. There are three parts to a goniometer. The first part is called the stationary arm. The stationary arm of the goniometer does not move. The second part of the goniometer is called the body. It contains a half circle that is positioned at the joint. This is where the angles of the joint can be read. The last part is called the movable arm and it moves with the part of the body that moves. See ***Figure 1*** for a reference. In this experiment the goniometer is aligned along the bones of the dominate arm and measures the total amount of motion in the elbow joint.

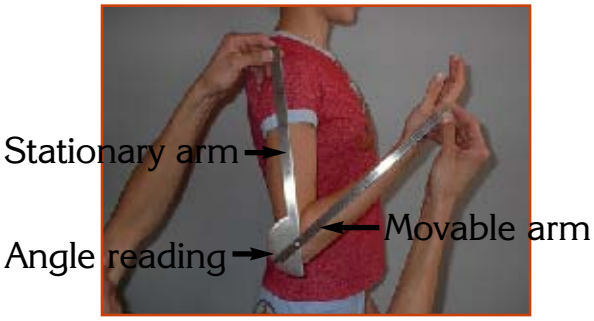


Figure 1 Parts of a Goniometer

DESCRIPTION: The students will measure the range of motion (ROM) of the elbow joint using a goniometer. Folded bath towels will be wrapped around the joint (simulating excess adipose tissue) to test any changes in ROM.

ACTIVITY MATERIALS:

- 2 bath towels
- Tape measure
- Large Rubber bands or string
- Goniometer
- Calculator

IDENTIFY VARIABLES IN THE EXPERIMENT: As directed on your ***Student Data Page***, write the independent variable and the dependent variable for this investigation and list some constants that would be important in controlling the experiment.

HYPOTHESIS: On your ***Student Data Page***, write a hypothesis based upon the background that predicts how the independent variable may affect the dependent variable. Be sure to write the hypothesis as an ***"if, then"*** statement.

PROCEDURE:

1. On your ***Student Data Page*** identify the variables, constants, and write a hypothesis. Be sure to write an ***"if, then"*** statement for your hypothesis.

2. Using the tape measure, the ***Data Collector*** measures the ***Test Subject's*** arm at the elbow joint and reads the amount in inches to the recorder.

3. ***The Recorder*** writes down the data and uses a calculator to convert the inches to centimeters.

$$\text{Centimeters} = \_\_\_\_\_ \text{ inches} \times \frac{2.54\text{cm}}{1\text{ in}}$$

4. The ***Data Collector*** uses the goniometer to measure the angle of the ***Test Subject's elbow***. Start by placing the dots on the reference points from ***Figure 2*** on the ***Test Subject's*** arm. First place a dot in the middle of the upper arm directly beneath the shoulder joint **(A).** Locate the part of the elbow that protrudes when the arm is bent at a 90^{o} angle. Place another dot about 5 cms from this bone near the crease on the inside of the arm **(B).** Place a third dot on the bone that protrudes from the wrist near the little finger and a fourth dot directly across from the previous dot on the part of wrist nearest the thumb **(C and D)**.

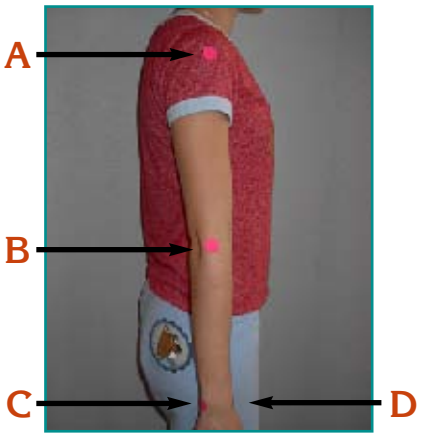
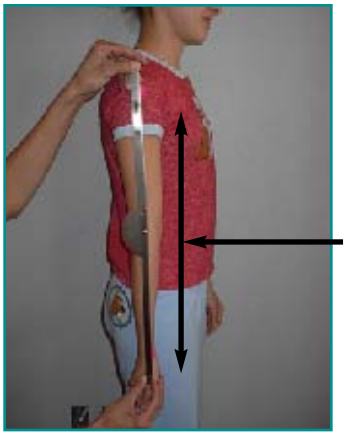


Figure 2

5. Line up the goniometer with dots and begin at 180 degrees. Be sure the ***Test Subject's*** arm is held close to the body with the palm of the hand facing up. Place the center point of the goniometer with the dot marking the elbow joint. Align the stationary arm of the goniometer with the shoulder and the moveable arm with the dot marking the wrist. See ***Figure 3*** for reference. The ***Recorder*** notes the beginning mark (0^{o}) in the column of the ***Test Subject's*** chart.



Line up goniometer with dots and begin at 180^{o}

Figure 3

6. As illustrated in ***Figure 4*** the ***Test Subject*** raises his or her forearm as far as possible while the ***Data Collector*** follows the movement with the movable arm of the goniometer. The ***Data Collector*** watches the movement to insure that the ***Test Subject's*** shoulder doesn't move from the starting position. The center point of the goniometer may not remain aligned directly with the dot marking the elbow joint as the arm movement proceeds. For accurate measurements it is more important to keep the movable and stationary arms aligned with the dots on the wrist and shoulder. See ***Figure 4*** for reference.

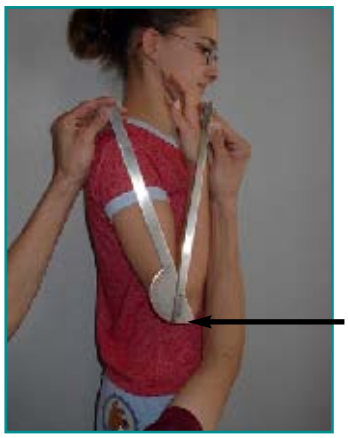


Figure 4

7. When the arm has been raised as far as possible, the ***Data Collector*** reads the angle measurement while the recorder writes the information in the appropriate column.

8. Remove the dot on the elbow. Fold the bath towel in half to form a square (hamburger style). Wrap the towel around the elbow of the ***Test Subject***. Tie a piece of string or large rubber band around the upper portion of the towel above the elbow joint. Tie another piece of string or large rubber band around the towel below the elbow joint to hold the towel in place.

9. Repeat steps 1 – 2 with the towel wrapped around the joint. ***Record*** the information in centimeters in the table.

10. Repeat steps 3 – 6 and record the starting and finishing angles.

11. Take the second bath towel and wrap it around the elbow joint. Again, tie the string or rubber bands above and below the elbow joint.

12. Repeat steps 1 – 2 with 2 towels wrapped around the joint.

13. Repeat steps 3 – 6 with 2 towels and record the starting and finishing angles.

Station 4 Card: Measuring Range of Motion of Knee Joint

PROBLEM STATEMENT: How does obesity affect your Range of Motion?

ACTIVITY BACKGROUND: The amount of motion a joint can perform is called ***range of motion*** (ROM). ROM is important for mobility. If the ROM of a joint is impaired, it results in limited function and mobility. The instrument used to measure the ROM of a joint is called a ***goniometer***. The term goniometry comes from the Greek words "gonia" meaning angle, and "metron" meaning measure. There are three parts to a goniometer. The first part is called the stationary arm. The ***stationary arm*** of the goniometer does not move. The second part of the goniometer is called the ***body***. It contains a half circle with degrees of motion marked and is positioned at the joint when taking a measurement of ROM. This is where you read the angles of the joint. The last part is called the ***movable arm*** and it moves with the part of the body that moves. See ***Figure 1*** for a reference. In this experiment the goniometer is aligned along the bones of the dominate leg and measures the total amount of motion in the knee joint.

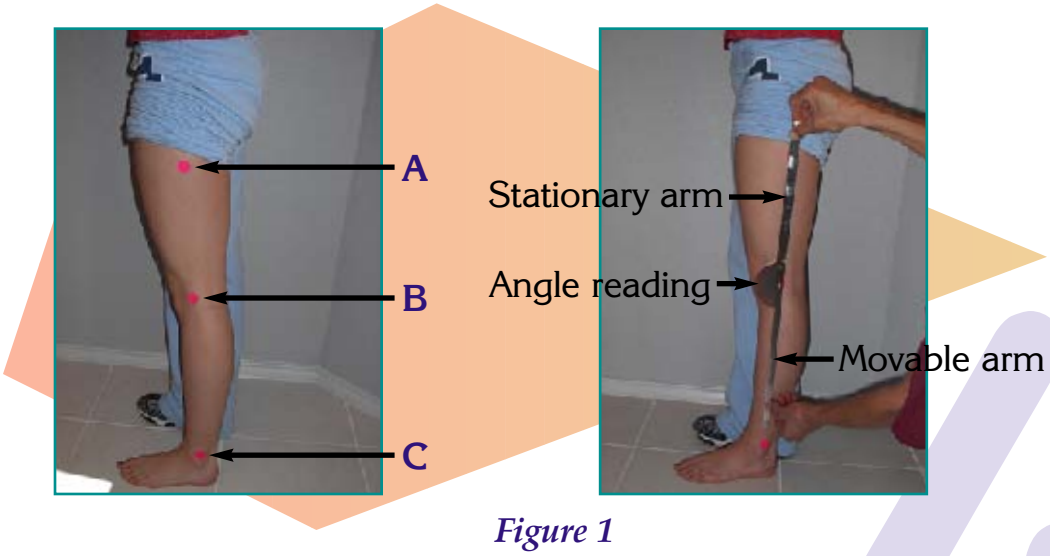


Figure 1

DESCRIPTION: The students will measure the ***range of motion*** (ROM) of the knee joint using a goniometer. Folded bath towels will be wrapped around the joint (simulating excess adipose tissue) to test any changes in ROM.

ACTIVITY MATERIALS:

- 2 bath towels
- Goniometer

- Tape measure
- Large Rubber bands or string
- Calculator
- 1 copy ***Student Data Page*** *(per student)*

IDENTIFY VARIABLES IN THE EXPERIMENT: As directed on your student data page, write the independent variable and the dependent variable for this investigation and list some constants that would be important in controlling the experiment.

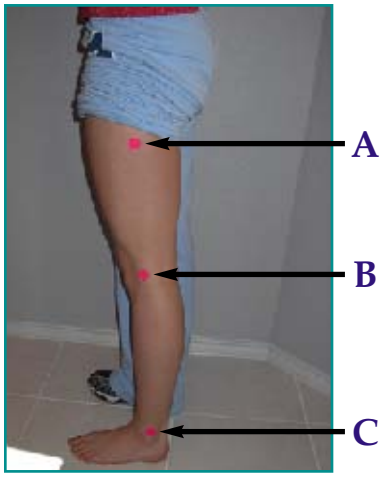
HYPOTHESIS: On your ***Student Data Page***, write a hypothesis based upon the background that predicts how the independent variable may affect the dependent variable. Be sure to write the hypothesis as an ***"if, then"*** statement.

PROCEDURE:

1. Using the tape measure, the ***Data Collector*** measures the ***Test Subject's*** leg at the knee joint and reads the amount in inches to the ***Recorder***.

2. The Recorder writes down the data and uses a calculator to convert the inches to centimeters.

$$\text{Centimeters} = \_\_\_\_\_ \text{ inches} \times \frac{2.54\text{cm}}{1\text{ in}}$$



3. The ***Data Collector*** uses the goniometer to measure the angle of the ***Test Subject's*** knee. Place dots on the ***Test Subject's*** dominate leg. Place the first dot in the middle of the leg just beneath the hip joint (A). Bend the ***Test Subject's*** knee and locate the space beneath the knee cap. Position the dot to the side of the knee directly beneath the hip dot (B). Place the third dot directly on the bone protruding from the ankle (C).
4. Stand the ***Test Subject*** with a supporting surface near the side opposite from the leg being tested. The ***Test Subject*** should stand on both feet with the hand opposite the leg being tested resting on the table for balance. Place the center point of the goniometer dot marking the knee. Align the stationary arm with the dot on the hip and the movable arm with the dot on the ankle. The ***Data Collector*** notes the beginning angle in the appropriate column on the record sheet.

Line up goniometer with pivot point and dots, begin at 180°

5. As the ***Test Subject*** lifts the lower leg as far as possible, the ***Data Collector*** follows the movement with the moveable arm. The ***Data Collector*** reads the information to the ***Recorder*** to put into the chart.

6. Remove the dot on the knee. Fold the bath towel in half to form a square (hamburger style). Wrap the towel around the knee of the test subject. Tie a piece of string or large rubber band around the upper portion of the towel above the knee joint. Tie another piece of string or large rubber band around the towel below the elbow joint to hold the towel in place.

Read the larger angle measurement (in this photo approximately 130°) OR read the small angle and subtract from 180°

7. Repeat steps 1-2 with the towel wrapped around the joint. Record the information in centimeters in the table.

8. Repeat steps 3-5 and record the starting and finishing angles.

9. Take the second bath towel and wrap it around the elbow joint. Again, tie the string or rubber bands above and below the elbow joint.

10. Repeat steps 1-2 with 2 towels wrapped around the joint.

11. Repeat steps 3-5 with 2 towels and record the starting and finishing angles.

Station 5 Card: Time To Get Up

PROBLEM STATEMENT: How does obesity affect moving from a lying position to a standing position and walking? In this activity, you will compare the performance of a daily task with and without extra weight and materials. The ***Test Subject*** will perform the act of getting up from a lying position and walk 3 meters while being timed.

ACTIVITY BACKGROUND: Do you ever watch T.V. while sitting or lying on the floor? Do you ever feel discomfort when trying to get up from the floor? It may seem like a simple task with no complications, but suppose you weighed an extra 100 pounds. Then, might you experience discomfort? Although getting off the floor is a task we perform daily, someone who is obese will experience difficulties. Obese individuals contain extra adipose (fat) tissue. This extra bulk (tissue) can limit how far an individual can reach and how fast he or she can move. Individuals who are overweight also experience more joint pain when conducting daily activities compared to people who are not overweight. In this experiment you will demonstrate the limitations an obese person experiences when getting off the floor.

ACTIVITY MATERIALS:

- King size pillow
- Paper
- String
- Marker
- Ankle weights (2)
- Tape
- Wrist weights (2)

IDENTIFY VARIABLES IN THE EXPERIMENT: As directed on your student data page, write the independent variable and the dependent variable for this investigation and list some constants that would be important in controlling the experiment.

HYPOTHESIS: On your ***Student Data Page***, write a hypothesis based upon the background that predicts how the independent variable may affect the dependent variable. Be sure to write the hypothesis as an ***"if, then"*** statement.

PROCEDURE:

1. Take two sheets of paper and write **"Start"** on one paper and **"End"** on the other. This should be completed by the ***Reader***.
2. The ***Recorder*** will mark 3 meters on the floor. Place the **"Start"** sign at the beginning of the 3 meters. Place the **"End"** sign at the end of the 3 meters.
3. Lay the ***Test Subject*** on the floor with their feet slightly in front of the **"start"** sign.
4. When the ***Data Collector*** says **"GO"**, the ***Test Subject*** will get up to standing position and walk the three meters at a normal pace. The ***Data Collector*** will start the stopwatch at **"GO"** and stop the stopwatch when the test subject has walked past the **"End"** sign.
5. The ***Recorder*** will place the time in seconds on the data table.
6. Repeat two more times for a total of three trials and record the data.
7. The ***Data Collector*** will assist the ***Test Subject*** with putting on the weighted gear. Place the pillow in front of the ***Test Subject***. Tie a string around the pillow and body of the ***Test Subject***. Be sure the pillow does not slide, but do not tie the string too tight.
8. Sit the ***Test Subject*** on the floor. Place the ankle weights and wrist weights on the ***Test Subject*** with the help of the ***Data Collector***.
9. Lay the ***Test Subject*** on the floor with their feet slightly in front of the **"Start"** sign.
10. When the ***Data Collector*** says **"GO"**, the ***Test Subject*** will get up to standing position and walk the three meters at a normal pace. The ***Data Collector*** will start the stop watch at **"GO"** and stop the stop watch when the ***Test Subject*** has walked past the **"End"** sign.
11. The ***Recorder*** will note any differences in methods used by the ***Test Subject*** to get up.
12. The ***Recorder*** will place the time in seconds on the data table.
13. Repeat two more times for a total of three trials and record the data.

Station 6 Card: Let's Take A Walk

PROBLEM STATEMENT: How does obesity affect moving from a sit to stand position and walking?

ACTIVITY BACKGROUND: Obese people generally have less muscle strength than people who are not obese. This hinders their ability to complete daily tasks. When obese people perform daily functions they perform the tasks at a slower rate and are exposed to musculoskeletal fatigue and possible injury. Standing from a sitting position and walking are daily tasks are more difficult for obese people. Obese people must modify how these tasks are completed to compensate for the added weight and tissue bulk. The amount of motion a joint can perform is called ***range of motion*** (ROM). ROM is important for mobility. If the ROM of a joint is impaired it results in limited function and mobility. The ***base of support*** is the part of the body that is touching the surface and the surrounding area. When walking, an obese person has a wider base of support and a decreased range of motion because of the additional fat tissue around the limbs and joints. When trying to stand, an obese person must change the positioning of their feet on the floor to stand up. In this activity the students will measure and observe the modifications obese people perform to complete a daily task.

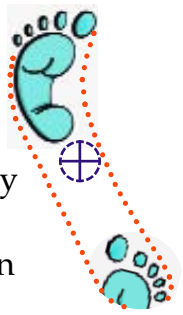


Figure 1

DESCRIPTION: The students will compare the performance of a daily task with and without extra weight and materials. The test subject will perform the tasks of standing from a sitting position and walking.

ACTIVITY MATERIALS:

- King size pillow
- 4 bath towels
- String
- Shallow tray
- Ruler
- Goniometer
- Ankle weights (2)
- Talc powder
- Meter stick
- Chair without wheels
- Dark colored butcher paper

PROCEDURE:

1. The ***Reader*** will read all of the instructions throughout this activity. Be sure the group members are completing each task and doing their job.
2. Measure and cut 2 meters of butcher paper.
3. The ***Reader*** places the chair at one end of the butcher paper. The chair should face the other end of the butcher paper. This can be done by the ***Recorder*** and ***Reader***.
4. Draw a horizontal line where the front legs of the chair are located on the butcher paper. This line will be used as a starting point.

5. The ***Data Collector*** adds talc powder to the shallow tray.
6. The ***Test Subject*** sits in the chair and removes his shoes and socks. The ***Data Collector*** will assist the ***Test Subject*** by placing the tray of talc powder near the ***Test Subject***.
7. Place the feet of the ***Test Subject*** in the talc powder. Do not put your feet on the butcher paper. Avoid putting any marks from the talc powder on the paper at this time.
8. Next, the ***Test Subject*** will stand. The ***Data Collector*** will count to 3 and then the ***Test Subject*** will walk to the end of the butcher paper, leaving footprints from the powder.
9. At the footprints where the ***Test Subject*** waited for three seconds, the ***Data Collector*** takes the ruler and draws a horizontal line at the end of the heel mark closest to the starting line. Measure the distance from the start line to the heel line. The ***Recorder*** will record this in the data table.
10. Next, the ***Data Collector*** will draw a circle around the second set of footprints. These are the prints of the ***Test Subject's*** right and left foot when he began walking. Using the ruler, measure the distance from the beginning of one foot to the end of the other foot. The horizontal distance between these points is the base of support, See ***Figure 2***. The ***Recorder*** will record the data in the table.
11. Using a goniometer, measure the ROM of the joint without bulk. Record the results in your ***Student Data Page***.

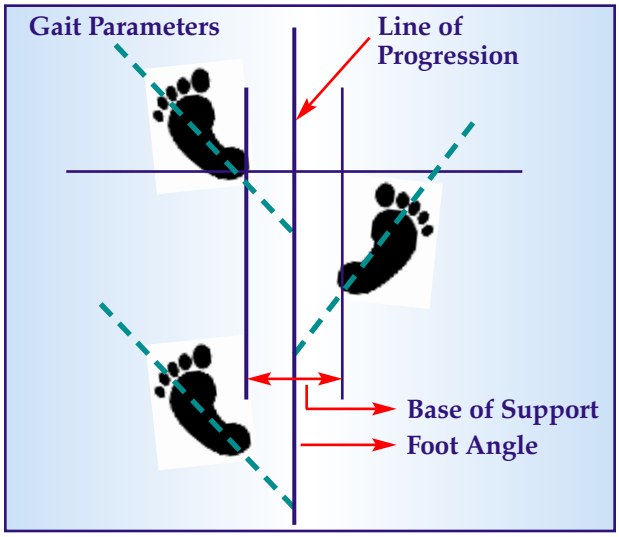


Figure 2

12. With the assistance of the ***Data Collector*** the ***Test Subject*** applies the additional bulk (weight). Fold the bath towel in half to form a square (hamburger style). Wrap two towels around each knee of the test subject. Tie a piece of string around the upper portion of the towel above the knee joint. Tie another piece of string around the towel below the elbow joint to hold the towel in place.
13. Vertically place the pillow from chest to legs on the test subject and tie a piece of string around the pillow to hold it in place.
14. Help the ***Test Subject*** sit in the chair and put on the ankle weights.
15. Repeat steps 4-11 with the added bulk (weight) on the ***Test Subject***.

Station 7 Card: BMI

PROBLEM STATEMENT: How do you calculate and interpret your BMI?

DESCRIPTION: In this activity you will be using task cards to practice calculating a person's BMI. At the end you will measure your own height and weight to determine your BMI. ***This will not be shared with the group.*** After you have calculated your BMI you can use the CDC website to interpret your BMI results.

ACTIVITY BACKGROUND: ***The body mass index (BMI)*** is one tool used to determine if a person is obese. BMI gives you an idea of how much body fat you have. BMI is a ***ratio of weight to height*** and can be calculated using one of the following formulas and locating the results on the age appropriate tables.

Weight Status Category	*Percentile Range*
Underweight	**Less than the 5th percentile**
Healthy weight	**5th percentile to less than the 85th percentile**
At risk of overweight	**85th to less than the 95th percentile**
Overweight	**Equal to or greater than the 95th percentile**

The percentile ranking for children indicates how the child's height and weight compares to other children in the United States. For instance a kid who measures above the 95th percentile is considered overweight because 95 percent of the population has a lower BMI.

ACTIVITY MATERIALS:

- Measuring tape
- BMI age appropriate chart
- Bathroom scale
- Calculator

PROCEDURE:

BMI PRACTICE

1. Use the ***BMI Character Cards*** to practice calculating BMI and recording the information in the ***Student Data Page***.
2. Draw 4 ***BMI Character Cards*** from the stack.

3. Using the cards, complete the data tables for each character and calculate their BMI using the following formulas.

Height in feet x 12 inches = Height in inches

Height in inches X 0.0254 = Height in meters

Mass in pounds X .45 = Mass in kilograms

$$\text{BMI} = \frac{\text{weight (kilograms)}}{\text{height (meters) x height (meters)}}$$

4. Use the chart to determine the BMI percentile and classification.

MY BMI

1. Place the 0 inches of the measuring tape where the floor and wall meet. Tape the measuring tape to the wall.
2. Remove your shoes and any hair ornaments that will interfere with measuring your height.
3. Stand with your feet together and against the wall. Make sure your legs are straight and arms are at your sides.
4. Ask a group member to assist you with measuring your height. Using a ruler your partner will place it on top of your head and hold it against the measuring tape to read your height.
5. Record your height in inches. Using the following formula, convert your inches to meters.

Height in inches X 0.0254 = Height in meters

6. Record your height in meters in the data table on your ***Student Data Page***.
7. Using the bathroom scale measure your weight in pounds. Remove your shoes and any heavy clothing like sweatshirts. Record your information in the table on your ***Student Data Page***.
8. Convert the pounds to kilograms using the following formula and record the measurement table on your ***Student Data Page***.
9. **Mass in pounds X .45 = Mass in kilograms**
10. Calculate your BMI by filling in your personal information in the formula. Record the information on your data table.

$$\text{BMI} = \frac{\text{weight (kilograms)}}{\text{height (meters) x height (meters)}}$$

11. Use the chart to determine the BMI percentile and classification and write them in the data table.