Postural Dynamics

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Postural Dynamics

Suggestions for the Teacher

Purpose:

The purpose of this activity is to gain an understanding of the multiple body components involved in everyday motions, such as standing upright and to recognize that we control small or large swaying with specific groups of muscles working together triggered by several senses, also working together.

Objectives:

Students will be able to explain:

- how the body maintains itself in an upright position.
- what senses we use when we stand.
- what muscles we use when we stand.
- what the body' limits are in maintaining an upright position.
- how body sways are similar and different.

Materials

- overhead projector
- metric measuring tapes (or rulers)
- protractor
- butcher paper
- chalk

Preparation and Procedures:

This activity includes three parts.

Part I: Unconscious swaying

1. Have student stand up, with their feet about shoulder width apart. They should look straight ahead and at eye level. Try to hold this position for about two minutes.
2. Student will note that they don't stand absolutely still, but adopt a swaying pattern.
3. Ask students, "Which way are you swaying?" (Ans: Forward & backward, NOT from left to right.)
4. Ask students, "Which way do you feel yourself swaying more, to the front or to the back?" (Answers will vary depending upon each student's personal awareness.)
5. Ask students, "How are you controlling this sway?" (Ans: Students should start to note certain muscle groups controlling the sway. For forward sway, the gastrocnemius (ankle extensor), hamstrings (hip extensors), and paraspinals (back extensors) jointly contract (2) For backward sway, the tibialis (ankle flexor), quadriceps (knee extensor), and abdominals (hip flexors) jointly contract. Note: If

this is used as a beginning life science activity, the instructor might not want to stress this vocabulary, but concentrate on the general and common-name muscles and senses involved.

6. Ask students, “Can anyone recognize any one single muscle group dominating the sway control?” (Ans: Normally a few think they can note a single muscle group, but this is a good time to reinforce the concept that these muscle groups all work in concert.)

7. Ask students, “Did anyone not a certain pattern or cycle to their swaying?” (Answers will vary, if they’ve noted this at all.)

8. Have students stand up, with their feet about shoulder-width apart with their eyes closed. Try to hold this position for about two minutes. Students will note that they don’t stand absolutely still, but adopt a swaying pattern.

9. Ask students, “Which way are you swaying?” (Ans: Forward & backward, NOT from left to right.)

10. Ask students, “Which way do you feel yourself swaying more, to the front or to the back?” (Answers will vary depending upon each student’s personal awareness.)

11. Ask students, “How are you controlling the sway?” (Ans: Students should start to note certain muscle groups controlling the sway. For forward sway, the gastrocnemius (ankle extensor), hamstrings (hip extensors), and paraspinals (back extensors) jointly contract. For backward sway, the tibialis (ankle flexor), quadriceps (knee extensor), and abdominals (hip flexors) jointly contract.

12. Ask students, “Can anyone recognize any one signal muscle group operating exclusively or dominating the sway control?” (Ans: Normally a few think they can note a single muscle groups but this is a good time to reinforce the concept that these muscle groups all work in concert.)

13. Ask students, “Did anyone note a difference in swaying from when they had their eyes open?” (Answer: Many will note that the sense of sight more quickly controls the swaying tendencies. Others will not detect any difference.)

14. Ask students, “If you’re not controlling your upright posture by sight, what other sense or senses do you suppose is (or are) involved?” (Answers: The inner ear’s vestibular systems and the somatosensory fell or your feet within your shoes.)

Part II: Conscious swaying

1. Students should remain standing as in Part I.

2. Have students attempt to consciously sway forward several times, without taking a step.

3. Ask students, “How are you controlling this sway? (Answer should have to do with the students’ abdominals and quadriceps, again in concert. There should be little, if any, comments about ankle muscles involved in this activity, since the ankles play hardly any part. Some alert students may note the ankle muscle involvement, but most will probably concentrate on the former two muscle groups mentioned.)

4. Have the students attempt to consciously sway even further forward.

5. Ask students, “How are you controlling this sway?’ (Answer I had to take a step forward, or I would have fallen.”)

6. Ask students to draw a conclusion regarding the body’s ability to control certain actions such as swaying. Conclusion: There are practical limit within which the body can control itself with certain muscle groups. Beyond this, other actions must come into play e.g., the stepping response.

7. Help students draw the conclusion that they control their small or large swaying with specific groups of muscles working together triggered by several senses, also working together.

Part III: Measuring Sway

Students, in teams of two, complete the **Postural Dynamics Lab** data sheets.

If possible, have two or three overhead projectors, placed on tables about four feet from a dark surface, or the chalkboard. Also consider using floodlights attached to bookshelves. If the sun is fairly close to the horizon, it’s also a good shadow maker. Do not use flashlights because they’re too portable. A very stable light source is needed.

Have a volunteer team “dry run” the lab activity for the class. Point out to the class where two good measurement points can be taken (e.g. from the top of the head’s shadow while upright to where the top of the head’s shadow moves on the board.) The degree of average sway measurement must be found as follows: As in Purpose #3 on the Student Activity Sheet (below), measure the distance the team member’s shadow moves on the blackboard. On butcher paper spread on the floor, draw a straight line corresponding to a team member height (in centimeters); see the diagram below. At one end of the height line (HL) draw (at right angles to the height line), the distance of one sway (S) - either forward or back. Connect the other end of the sway line back to the end of the original height line. Use the protractor to measure the acute angle (AA) formed. The measurement is the number of degrees of sway.

If a team is having difficult measuring because a team member’s sway is either of rapid frequency or of very small movements, you might have to form teams of four in order to have more “measurement” during these instances.

After all students have taken their measurements and recorded the data on the data sheets, the teacher may wish to compare all students by placing some of the data obtained on the chalkboard for discussion. Teachers might want to put only the averages for each team member up on the board in ascending order by average number of forward sways with

eyes open. The class might examine these numbers and determine if there are any patterns existing among the data: IS there a difference in taller and shorter people in these measurements?

You might want to address variables affecting the data, e.g. certain observers might count sways differently than others.

Safety:
Students need to be advised that the overhead projector lamp generates a considerable amount of heat. They should maintain at least a three-foot distance from the lamp when it is illuminated.

Questions to Ask:
See Preparation and Procedures

Where to Go From Here:

- Pose hypothetical situation to the students to determine how they think various factors affect swaying: If possible have them conduct interviews with healthcare professional or athletes to gather more information. Situations can include, for example, drinking alcohol; getting off a large roller coaster; running a marathon; or getting up first thing in the morning.
- In addition, you could provide the students with sample data and ask them to graph the difference among the populations regarding swaying. They could relate this to population diversity.

Suggestions for Assessment:
The lab report can serve as an assessment tool as can the extension activities in the section above.

Postural Dynamics

Student Activity Sheet

Purpose

- To find out if there are demonstrable, measurable movements in the human body when it is attempting to stand upright for several two-minute intervals.
- If there are such movements (called sways), to measure the frequency and extent of these sways, using the data sheet.
- If there are such measures taken on every team member, to find out if these measures are unique to each individual, or there are comparabilities with the data gathered.

Team Member Responsibilities

- Each team member should thoroughly read the **Postural Dynamics Data Sheet** and ask any questions prior to starting the **Lab**.
- Each team member should be familiar with the use of a protractor and how to take degree measurements of the team member's shadow during each sway. The teacher will demonstrate this method.

NORMAL POSTURAL SWAY					
Team member name: Feet shoulder width apart; eyes **OPEN,** looking forward at eye level; trying to hold position for 2 minutes. Repeat this three times.					
Time period	# forward sways	# backward sways	total # cycles	cycles per minute	average degrees of sway
First 2 minutes					
Second 2 minutes					
Third 2 minutes					
Feet shoulder width apart; eyes **CLOSED,** pointing forward at eye level; trying to hold position for 2 minutes. Repeat this three times.					

First 2 minutes					
Second 2 minutes					
Third 2 minutes					

Calculate the AVERAGE for each of the following items	
A. Average number of forward sways w/eyes open	
B. Average number of backward sways w/eyes open	
C. Average number of forward sways w/eyes closed	
D. Average number backward sways w/eyes closed	
E. Average cycles per minute (cpm), w/eyes open	
F. Average cycles per minute (cpm), w/eyes closed	
G. Average degree of sway w/eyes open	
H. Average degree of sway w/eyes closed	