"Forces during Circular Motion"

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I. DCPS Standards:

8.7.2 Observe and explain that when the forces on an object are balanced (equal and opposite forces that add up to zero), the motion of the object does not change.

8.7.6 Explain that if the net force acting on an object always acts toward the same center as the object moves, the object's path is a curve about the force center. (Motion in a circular orbit is the simplest example of this concept.)

II. Goals:

Students will appreciate that static equilibrium implies that all forces on an object balance (*i.e.* cancel) each other.

Students will understand that an inward force is required to keep an object in circular motion.

III. Objectives:

Students will analyze the forces acting on a pair of individuals in static equilibrium and a pair of individuals rotating around one another.

IV. Prerequisite Knowledge: **Centripetal Force** is the inward force exerted on an object to keep it in an orbit (or have it "travel in a loop").

Centrifugal Force is sometimes called a "fictitious" force since it does not appear in an inertial reference frame. It is the outward force felt by a rotating observer due to the fact that he/she is in an accelerated reference frame.

Static Equilibrium occurs when all the forces on an object cancel each other (the net force on the object is zero) and the object remains at rest.

V. Essential Questions:

What are the forces acting on the students when they are leaning apart at rest? Why don't they fall? What changes when the students begin rotating around one another? What would happen if they let go of each other?

VI. Materials: This activity involves a minimum of materials.

VII. Differentiating Instruction: This activity should pose no problem to speakers of English.

VIII. Rationale: This activity demonstrates the role of forces (and thus physics) during ordinary everyday motion.

IX. Activity Procedure The instructor can begin with a demonstration of centripetal force by (carefully) swinging an object attached to a string. The students should be asked what forces are acting on the object, and what keeps it going in a circle? A pair of volunteers can then stand facing each other in front of the class, grab each others' wrists and slowly lean back. The class is asked about the forces acting on the students. The participants then circle each other while holding each others' wrists, first slowly and then slightly faster. They are asked does the force they hold each other with increase or decrease with speed? [It increases.]

X. Evaluation and Assessment: The answers to the questions listed in the above procedure are

discussed with the instructor (reinforcing the terms “static equilibrium” and “centripetal force”), thus covering the information in the above DCPS standards. Students write their own statement saying what this demonstration has shown them about force. If time permits, the students can be led (with variation depending on the preparation level of the class) in constructing a diagram of the forces acting on the students both in the static equilibrium leaning position and in the rotational motion, which they record in their lab books.