Sports and recreation--A physicist's point of view

Learning Objective

After selecting an approved movement from a physical activity or sport, the student will be able to explain the reasoning behind various techniques involved in achieving optimum execution through physics concepts without using equations. The student should use only necessary and reasonable simplifications of body parts and/or equipment.

Key Concepts

We (sometimes unknowingly) use physics concepts every day.
Physics is more than just numbers and equations.

Activity: Creative Assignment

Description:

*C*hoose a move from a particular sport or physical activity (i.e., a ballet fouetté pirouette, a snowboarding toe-side turn, or a soccer bicycle kick) and receive approval from the instructor (who will ensure the project is neither too difficult nor too simple). Write a paper on the techniques involved in executing the move "perfectly". Your paper should include:

1.) step-by-step instructions to execute the move, such that your reader could try it
(Do you kick your straight leg up or bend your knee then flick your lower leg up?);

2.) your definition of "perfect"
(Does "perfect" reduce the risk of injury, improve accuracy, improve efficiency, or something else when compared to other methods or techniques?); and

3.) reasoning for and explanation of each movement in part 1 through physics concepts discussed in class (kinematics, force and torque, energy, linear and angular momentum, centre of mass, moment of inertia, etc.).

Guidelines:

- The purpose of this paper is to apply your conceptual understanding of physics. Your paper should be free of equations.
- Your paper should include at least three different physics concepts.
- Only simplify body parts and sports equipment if necessary to apply the concepts addressed in class. Use reasonable simplifications and do not over simplify (i.e., treating the thigh as a uniform cylinder is okay: treating the thigh as a thin rod or point mass is not okay). If you are unsure, ask.
- Your paper should be three pages or less (double spaced, regular margins, size 10-12 font, style: Arial, Calibri, or Times New Roman) with steps 1 and 2 combined taking no more than one page.
- At the end of your paper (not included in the 3 pages) you should attach a bibliography. All sources should be referenced according to MLA standards.

Timeline: The instructor should spend 10-15 minutes reviewing the assignment with students and answering questions. The students should be given 2-3 days to pick their topic and have it approved by the instructor, and then 2-3 weeks to complete the paper. Since the assignment requires knowledge from most of the course, this assignment should be given out near the end of the course.

Resources: All students should have access to a computer, a printer, and the internet.

Variation 1: Oral Presentation

Instead of giving this as a written assignment, the instructor may choose to give this as an oral presentation assignment. To make presentations more comprehensible, instead of step 1, students should find/make a video that portrays the move they pick or be able to demonstrate the move safely in the classroom. In addition to the timeline above, the instructor should allow 7-10 minutes of class time per student to present. On presentation days there should be a television or projector and screen available for students to use.

Variation 2: Class Activity

The instructor picks a movement from a physical activity or sport. The instructor tells the class to pay particular attention to each body part, and then shows a video of the move, demonstrates the move, or has a student demonstrate the move for the class. The instructor then guides the class through a discussion of what each body part does, the physics concept related to that motion, and why they do it that particular way (the "perfectness"), ensuring no one uses equations or oversimplifies the problem.

This class activity requires 10-20 minutes of class time (depending on the move and the amount of detail the discussion goes into); since the instructor is moderating the discussion, it can easily be shortened or extended. The instructor can also pick a move that deals only with the physics they have covered in the course thus far, lifting the restriction of being an "end of course" assignment.

For this class activity, the instructor should have the equipment necessary to demonstrate the move or a television/projector and screen to show the move to the students.

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