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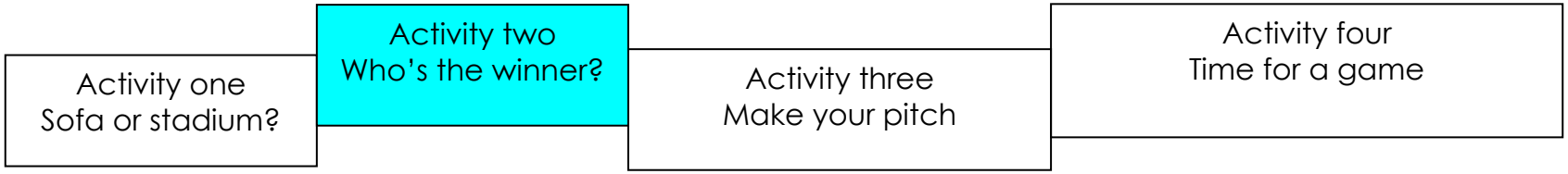
Unit 3: Question of sport – Activity two, who's the winner?



Required components:

- Who's the winner (.pps)
- Who's the winner (.xls worksheet)

Activity intention:

Who's the winner provides students with an opportunity to collect data which they can use as evidence to debate whether people should be encouraged to engage in computer-based sport activities. The investigation highlights how difficult it is to control all variables and therefore carry out a fair test. The students' evaluation of the investigation will allow them the chance to question the validity of the data, question the size of the data set used and question the time span data needs to be collected over before it can be used to confirm a claim.
Students will design a test to investigate the claim that using a Nintendo Wii computer game is a good way to keep fit and that people, therefore, should be encouraged to use them. The link between our pulse rate and the rate of aerobic respiration is made to help explain fitness levels and changes in our pulse rate during exercise.

'Who's the winner' was designed as a science activity but would be an excellent opportunity to be taught in conjunction with PE and mathematics.

Direct support for this activity can be found on the Faraday 09 website

Links to the 'new secondary curriculum' - Key Processes:
Science:
2.1a - practical and enquiry skills – use a range of scientific methods and techniques to develop and test ideas and explanations
2.1c - plan and carry out practical and investigative activities, both individually and in groups
2.2a obtain, record and analyse data from a wide range of primary and secondary sources, including ICT sources, and use their findings to provide evidence for scientific explanations
2.2 b - evaluate scientific evidence and working methods

Mathematics:
2.1c - simplify the situation or problem in order to represent it mathematically, using appropriate variables, symbols, diagrams or models
2.2e – make and begin to justify conjectures and generalisations, considering special cases and counter-examples
2.3c – be aware of the strength of empirical evidence and appreciate the difference between evidence and proof

Range and content:
Science:
3.3e – behaviour is influenced by internal and external factors and can be investigated and measured

Mathematics:
3.3a - the handling data cycle
3.3b - presentation and analysis of grouped and ungrouped data, including time series and lines of best fit
3.3c - measures of central tendency and spread

Resources:

- Stop watches
- Digital pulse rate monitors
- Nintendo Wii and TV, XBOX 360 or PS3 and TV with tennis game (results could be taken at home and viewed on YouTube)
- Tennis equipment
- Bottles of water
- Graph paper and log templates (this would be a good opportunity to encourage students to generate a graph from the spreadsheet using Excel)

Personal, thinking and learning skills (PLTS):
These generic skills, together with the functional skills of English, mathematics and ICT, are essential to success in life, learning and work
Team workers – collaborate with others towards a common goal
Effective participants – discuss issues of concern, seeking resolutions where needed and present a persuasive case for action

Curriculum opportunities:
Science:
4a - research, experiment, discuss and develop arguments
4c - use real-life examples as a basis for finding out about science
4k - make links between science and other subjects and areas of the curriculum

Mathematics:
4d - work on problems that arise in other subjects and in contexts beyond the school
4f - work collaboratively as well as independently in a range of contexts

ICT opportunities:
students to create a spreadsheet for the collection of class results and then generate graphs from this on Excel

Suggested learning objectives:

- To be able to evaluate the suitability of the data collected
- To be able to explain how pulse rate and respiration are affected by activity
- To explain how results and ideas can be changed when we consider other variables
- To interpret individual and group data on pulse rates, relating it to fitness levels
- To be able to evaluate the validity of a data set

Activity two, who's the winner?

Starter activities:
Show students the Faraday 09 website; Wii, application video clip. The starter activity needs to be used to establish what the group understands by the meaning of the word 'fitness' and to clarify a group definition. Students need to have a basic understanding that energy is 'made' by the body during respiration and this involves glucose reacting with oxygen. We use this energy during exercise and in order to get more oxygen and glucose to our cells, our heart has to pump blood faster around our bodies. A measure of this is changes in our pulse rate.

1. In groups, ask students to discuss and provide answers for the following:
    - What do we mean by someone's level of fitness?
    - What is a pulse rate?
    - What is respiration and where does it happen?
    - Why do we need our heart and blood?
    - What is energy and how does it relate to activity?
2. Ask the students to rank themselves within the class, in terms of who they believe is the fittest (the students will need to revisit these predictions later). Then ask the students to create a concept map of the top five activities they do every week, and how much energy is used on a scale of 1 to 10 (see Who's the winner (.pps), slide 1)
3. Ask the students whether they think we are 'fitter today than 50 years ago?' (see Who's the winner (.pps), slide 2)

Main learning activities: science focus;

In this activity, students will compare how their resting pulse rate changes when they have been playing a normal games console, playing Wii tennis on the Nintendo Wii, and playing real tennis. Students will use the rise in pulse rate as an indicator that the activity increases pulse rate and, therefore, is an activity that could be used in a fitness programme.
Students will also look at the recovery rates for each activity and consider if this is a useful piece of data to have.
At the end of the data collection, the students will have the opportunity to talk about certain elements of the design of the investigation, what the data actually shows and what, if any, are the limitations of the data.
In groups of three:

- Students take their resting pulse and then complete the static activity of using a computer console game for 10 minutes. They sit down immediately, wait one minute, and then take their pulse rate for 30 seconds. Additional pulse rates can be taken between 2 and 2½ minutes and between 3 and 3½ minutes. This is their recovery rate and is an accepted indicator of their fitness level (Harvard steps test). The level of fitness is then found by applying the fitness index score (see www.topendsport.com/testing/test/step-harvard.htm for scoring table)
- Excel spread sheet available if needed to record information

- Once the pulse rate has returned to the resting pulse they can then repeat the process, but this time using the Nintendo Wii
- The next lesson they have, they repeat the process again doing the static activity, but this time playing the tennis or doing another suitable energetic activity
- Students will now have two pieces of data for each activity, the pulse rate at the end of each activity and the recovery rate
- Students then need to plot a graph of their results. The graph should have three lines representing each member of their group in different colours, with the X axis measuring what has changed and the Y axis representing what was being measured

Students analyse the results. The following questions can be used to support this analysis:

- How is my pulse rate affected by the different activities?
- Which activity affected pulse rate the most and why? (students should be using some or all of the following key words: Heart rate, oxygen, glucose, energy, carbon dioxide, kinetic energy, cell, muscle, respiration)
- Why did the normal console still affect my pulse rate?
- What are the differences between me and my friends?
- Were there more differences between me and my friend of the opposite sex?
- Do the results match what we predicted? Explain.

Students now need to have the opportunity to discuss their data and the analysis of it. They will then need to evaluate the design of the investigation. The following questions could be used as a basis of this discussion:

- Is a rise in pulse rate an indication that the person is doing some form of aerobic exercise?
- How high does your pulse rate need to go to indicate you are doing some aerobic form of exercise?
- In your opinion, would you agree or disagree that each activity involves doing some exercise?
- What does the recovery rate show you for each activity? Is this a useful piece of data to collect?
- How could you improve your data set?
- Does your data prove that the Nintendo Wii is a good form of exercise?
- What other data would you need to collect in order to argue this claim convincingly?
- What variables would affect this investigation, which could you control and which couldn't you control?
- If variables can't be controlled, does this invalidate your findings?
- Why did you need to do the static activity on each day?
- Why should you do the two 'sport' activities some time apart?
- What would you need to do to improve this investigation?

Main learning activities: mathematics focus:
Ask the students to visit the following website:
http://nrich.maths.org/public/viewer.php?rss=1&obj_id=6178&part=index. The site starts to explore the concept of making and understanding hypotheses - this is key to mathematical learning. Throughout this activity, students need to understand correlation - ask the students to answer the questions on the following site: http://www.mcckc.edu/longview/ctac/psych3.htm. The examples should challenge students' perceptions of causality.

Worksheet 1, used in the activity above, generates cumulative data. A useful, though quite lengthy, resource to support understanding of cumulative frequency tables and graphs can be found at: http://www.teachers.tv/video/1852 . The data referred to is from skateboarders and through the use of body scanning at the London College of Fashion where a virtual tape measurer collects up to 130 measurements in seconds. If time is limited, students could be encouraged to watch this video at home. Box plots are a useful means of identifying outliers and comparing distributions - see http://www.netmba.com/statistics/plot/box/ for information about their construction.

Extension activites: science
Students could be asked to produce a survey that would give them a realistic picture of which of the three activities (explore above) has the most advantages to society.

Using Who's the winner (.xls worksheet) – sheet 2, ask the students to collect 25 responses. Students should then discuss the results. The debate should revolve around some of the following issues:

- Tennis burns the most calories compared to the other activities
- Access to tennis courts compared to the Wii means that the Wii is played far more often
- The Wii is a device that engages families in productive communication throughout the world
- The Wii and the Wii games are expensive and therefore exclusive
- Tennis and other sports encourage team play and co-operation

Mathematics
In statistics, rank correlation is a means of comparing the relationship between different sets of ranked data. Spearman's rank correlation coefficient is simple to use - students can research the coefficient, e.g. http://en.wikipedia.org/wiki/Rank_correlation then use it to analyse data.
Students can set up their own spreadsheet, or use another program, for speedy processing.