

theme:

leisure & lifestyle

job:

Nick Dawes, First Team Physiotherapist,
Bristol City Football Club

activity outline

In this activity, pupils investigate some of the methods used to assess fitness: flexibility (sit and reach test) and cardiovascular fitness (pulse rate and blood pressure measurement before and after exercise).

You will need one lesson.

Pupils work in pairs.

The pupil sheet provides an introduction and step-by-step instructions for each procedure, as well as a results table to be completed.

You may find it helpful to ask the PE department for advice about suitable exercises.

Teacher notes overview

- 1 Curriculum links:** where this activity can fit with the 2008 KS3 Programme of Study and Scottish 5-14 Science Curriculum.
- 2 The Video:** providing a synopsis of the video content and ideas for viewing.
- 3 The Practical:** including *Equipment lists*, *Health and safety notes*, a *Possible approach* (a comprehensive, suggested way of planning the lessons) and an *Underlying science* section (providing detailed information about the various scientific principles involved).
- 4 Possible extensions:** suggestions for other practical activities using the video, or extending the suggested activity.
- 5 Associated jobs:** guidance on how to deliver a plenary activity (or, if you wish, a stand-alone activity) focusing on the video interviewee, including a photo of the interviewee to place at the centre of a spider diagram.

curriculum links

This lesson can be used to help teach part of the 2008 Key Stage 3 Programme of Study (England and Wales):

Range and Content:
3.3a, c, d, e

Key Processes:
2.1c, 2.2a, b

Attainment Targets:
AT1, AT2

Curriculum Opportunities:
4a, b, c, e, h, j, k

Key Concepts:
1.1b, 1.2a, 1.3a

This lesson can be used to help teach part of the Scottish 5-14 Science Curriculum:

Main curricular links

LT&PL2 The processes of life

Attainment Targets

Knowledge & understanding:

Level E

- Identify, name and give the functions of the main organs of the human body

Investigating skills:

Level D

- Make an appropriate series of accurate measurements
- Draw conclusions consistent with findings



the video

Synopsis of the video

Among other things, Nick makes these interesting points:

- He was a semi-professional footballer, but continued to study sports science in case he didn't make it.
- On match day, he spends his time watching players who are returning from injury, or players who may be carrying an injury – he can't just sit and enjoy the match.
- When studying to become a physiotherapist you spend time working for the NHS, private practices and various types of sport – you don't have to work for a football team.
- It's a tough job with long hours, but it is incredibly rewarding when you nurse someone back to full fitness.

Watching the video

There are a number of things you might do before showing the video to your class.

- 1** Preview the video and write a few quick-fire questions. Then you can tell your class that they will be tested on their observation when it's finished. This is an excellent way of encouraging them to pay attention!
- 2** Ask pupils to watch the video through once. Then ask them to generate one question that could be answered from the video and one question they would like to ask but the video did not answer. These questions are then exchanged with another pupil and the video is watched a second time. This gives pupils an opportunity to focus on something they may have missed first time, and provides a basis for discussion on what was learnt from the video, and what additional information is needed.
- 3** Ask pupils what sort of person might become a physiotherapist. Does anyone in the class think they'd like to work in sport? When the video has been watched, ask the questions again. Has anyone changed their mind/opinions?
- 4** Ask pupils to spot the science in the clip.



the practical

Pupils may carry out either or both of the procedures, depending on available time and equipment.

1. Sit and reach test

Equipment

(per pair)

- box 30-40 cm high, and similar width (e.g. storage box or empty wine case)
[alternatively, a laboratory stool on its side – though this requires more space]
- metre rule
- transparent adhesive tape
- floor mat (optional)

If the box is empty, the partner pupil may need to hold it to prevent it moving during the test.

Health and safety

- Pupils should perform some muscle warm-up activities before the sit and reach test. Consult a PE colleague for suitable suggestions.
- Stress that the test is an investigation, **not** a competition. Pupils must not attempt to push themselves beyond their normal reach. This would risk injury, as well as invalidating the results.
- Reaching forward must be a gradual movement, not a sudden lunge or rocking bounce.
- The reach test may be unsuitable for some pupils. They should not participate against their wishes.

Alternative test

Those who may have difficulty with the reach test described could try it with one leg bent. The other leg should be straight, with the back of the knee on the ground, as in the normal test.

These results can be compared with each other, but not with the normal results.

Underlying science

- Body movements are produced by muscles contracting and relaxing.
- The structure of a joint restricts its movement, but its flexibility (degree of movement) is also often limited by the flexibility of the muscles (their ability to contract and relax). The less flexible the muscles, the less flexibility and movement in the joint.
- Active use of muscles and controlled stretching exercises increase flexibility, so regular sport players tend to be more flexible than people with less active life styles.
- Muscle injury reduces flexibility – of muscles, and thus of joints. Measuring flexibility over a person's injury recovery period provides a measure of their return to fitness.
- The sit and reach test measures flexibility that is dependent on muscles in the back of the thighs (hamstring muscles) and lower back.
- These muscles stretch as the person reaches forwards. The more flexible the muscles, the further the person can reach.
- Reach is also affected by anthropometric factors – length of the limbs in relation to the trunk. Longer arms or shorter legs allow a longer reach for the same angle of the back.
- For a person of average body proportions, a negative reach value (fingers not reaching the toes/50 cm mark) indicates poor flexibility and fitness.
- The reach of adults tends to decrease with age as the muscle fibres become less flexible.
- Females, whether children or adult, tend to have longer reach than males of similar age.

2. Assessing cardiovascular fitness

Equipment

(per pair/group)

- pulse rate/heart rate monitor (or sensor + data logger) [optional]
[Alternatively, pupils count pulses by hand.]
- blood pressure monitor [optional]
[A monitor that displays both blood pressure and pulse rate would be ideal.]

Health and safety

- Pupils should perform some warm up activities before the cardiovascular test. Consult a PE colleague for suitable suggestions.
- If doing step ups, make sure the step is firmly against a wall or similar.
- Blood pressure monitors should preferably be automatic, to avoid the danger of over constriction with a manually inflated cuff. Their use must be supervised.
- Aneroid or mercury sphygmomanometers are not suitable for pupil use at this level, but could be demonstrated if desired.
- For some pupils, the three minutes hard exercise may need to be reduced, or abandoned.

Underlying science

- The pulse is caused by the heart pumping at regular intervals, and can be felt in various parts of the body.
- Pulse rate normally equates with heart beat rate.
- The pumping heart produces pressure to make the blood flow.
- When the heart contracts to pump, the pressure is at its highest – the *systolic pressure*.
- When it relaxes, the pressure falls to its lowest level – the *diastolic pressure*.
- Blood pressure is measured by squeezing an artery with an inflatable ‘cuff’ around the arm to stop the flow. Two measurements are taken while the cuff pressure is gradually released:
 - ▶ cuff pressure that just allows blood to start flowing again through the restricted artery
[= pressure of the blood forcing its way through at maximum (*systolic*) pressure]
– detected through a stethoscope as a whooshing or thumping sound due to turbulence

- ▶ cuff pressure that just allows smooth blood flow to return
[=pressure of blood flowing through the unrestricted artery at minimum (*diastolic*) pressure]
– detected when the sound of turbulence stops
- Blood pressure is expressed as the two readings, *systolic/diastolic*.
- During exercise, muscles use more oxygen to generate the required energy.
- Blood flow needs to increase to carry more oxygen to the muscles.
- The heart beats faster and pumps more blood per beat, so pulse rate and blood pressure increase.
- When exercise stops, pulse and pressure gradually return to normal.
- A fit body adapts to changing demands more easily, so takes less time to return to normal.

Possible approach

This topic offers the chance to extend pupils' ideas of what 'science' includes, by discussing:

- lesser-known medical techniques, such as physiotherapy, chiropractice and massage
- development and expansion of Sports Science and related career opportunities
- substance abuse in sport

Relate sports performance to muscles and the ability of the cardiovascular system to supply them with sufficient oxygen. Fitness is a measure of whether these systems are working as well as they could, or whether their performance could be improved by fitness training.

Discuss the importance of assessing fitness, and methods employed. The practicals illustrate both aspects of fitness.

Pupils should work in pairs. They may be set either or both of the procedures, depending on available time and equipment. Since availability of blood monitors is likely to be limited, half the class could do each procedure and then share results – or swap procedures if time allows.

1. Sit and reach test

Stress that the test is an investigation, **not** a competition. As well as risking injury, pushing themselves beyond their normal reach would give abnormal readings, making comparisons invalid.

The reach must be held for a few seconds. This will:

- enable the partner to take a distance reading
- help to prevent participants lunging or bouncing forward.

2. Assessing cardiovascular fitness

Pupils need to be familiar with the concepts of pulse rate and blood pressure, and know how to use the monitors safely and correctly.

It is important that the initial measurements are taken after at least five minutes at rest – for instance, sitting still while the teacher introduces the activity. If done after the sit and reach test, the pupil who has just been reaching should become the partner/recorder for the cardiovascular test.

If pulse rate monitors are not available, explain how to count the pulse manually – either in the wrist or the temple (just in front of the top of the ear).

If blood pressure monitors are not available, pupils will have to investigate pulse rate changes only.

Discuss what the results show, and whether the measurements are useful indicators of fitness.

Extension 1 below suggests some ways of displaying results to help with the discussion.

possible extensions

1. Treatment of results

Collected results may be displayed in various ways to illustrate the effects. These might include:

- tally charts of the number of pupils whose reach was:

- ▶ more negative than -5 cm
- ▶ between -5 and 0 cm
- ▶ between 0 and 10 cm
- ▶ between 10 and 20 cm
- ▶ more than 20 cm

[Adjust tally ranges according to pupils' results]

- plotting pulse rate and blood pressure against time
- tally charts of the number of pupils whose pulse rate returned to normal (resting rate):
 - ▶ within 4 minutes
 - ▶ in 5 to 7 minute
 - ▶ in 8 to 10 minutes
 - ▶ taking more than 10 minutes
- scatter graphs of:
 - ▶ reach against number of hours per week spent playing sport
 - ▶ pulse 'return to normal' time against number of hours per week spent playing sport
 - ▶ reach against pulse

to see whether there is any apparent connection.

[The term 'correlation' is probably best avoided at this level.]

Note: For this purpose, other energetic or body flexing activities, such as ballet or dance activity, should be counted as sport.

2. Other measures of fitness

Devise and/or look up practical methods for assessing other aspects of fitness, such as speed or agility.

Note: Any practical investigations must be risk assessed by a competent person familiar with the risks of injury posed by carrying out tests incorrectly.



associated jobs

A STEM (Science, Technology, Engineering and Maths) education provides pupils with skills and knowledge that are useful in all sorts of careers. The video demonstrates how Nick, a physiotherapist at Bristol City Football Club, uses such skills on a daily basis.

Nick works with numerous people – some directly, some indirectly. Some use STEM skills, others don't. By exploring this network of associated jobs, pupils will, hopefully, begin to see that even those in non-STEM jobs will find STEM skills useful – if they're communicating with someone "in-STEM", for example, some knowledge of their work will be a great help.

Nick's spider diagram

Try placing Nick at the centre of a spider diagram (we've provided a photo of Nick which you could use – see overleaf). You could either create worksheets for pupils to complete themselves, or create the diagram on your whiteboard and then pool ideas.

Ask pupils: "who does Nick work with". They may draw information from the video – Nick talks about the rest of the medical team and the manager – or they may come up with new ideas, such as dieticians, fitness coaches or sports psychologists. Other suggestions might include the players, other physiotherapists, paramedics or providers of sports equipment and medical equipment.

Now ask pupils which of those jobs are clearly "in-STEM". Who else might find some STEM skills helpful? Why?

You could extend this by taking any one of the associated jobs and placing them at the centre of a spider diagram, and starting the process again.

theme: **leisure & lifestyle**



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Studying science and maths can transform your career options. Future Morph: become someone.