



# Exercise

## How does activity affect me?



## Terrific Scientific Campaign

# Investigation: Exercise

**Hello! Welcome to the Exercise Investigation from the Terrific Scientific campaign!**

At BBC Terrific Scientific, we think it is vital to develop science learning in primary schools across the UK. By taking part in this activity, you will be developing your class's scientific thinking and investigative skills.

**At Key Stage 2 (Second Level), children need to:**

- **Develop** investigative skills.
- **Understand** when it is important to control variables.
- **Predict, observe and record** results.
- **Draw conclusions** (which may generate new questions).
- **Understand** the need to repeat activities.
- **Record** what they see and not what they want to see.



We have incorporated these principles into this exciting activity. We've made it suitable for primary classrooms by using readily available equipment and suggesting opportunities for support and differentiation.

The BBC deems this activity safe if following some basic precautions. It is your responsibility as a School to carry out your own risk assessment and we recommend you consider the risks and mitigations we have described in this activity pack, as well as any risks which may be relevant to your specific class environment.

As well as these key working scientifically principles, we have made sure there are links to the science curriculum for each nation, as well as cross-curricular opportunities for further learning. We think these are just as important, as they help to explain the relevance of science and how it links to the world around us.

### The website:

Find out more about  
Terrific Scientific and our  
other investigations at:

[bbc.co.uk/terrificscientific](http://bbc.co.uk/terrificscientific)

On our website you will find a supporting 'How to' film, which shows teachers and teaching assistants how to set up and carry out the experiment. You will also find additional resources including a step-by-step lesson presentation, featuring an introductory film, which sets the investigation into context for your students.

We originally partnered with the universities of Edinburgh and Stirling for this investigation. Data collected by participating classes helped to further their scientific learning and gave input to professional scientific research aimed at helping to understand the impact that short bursts of exercise may have on the well-being and attainment of children in the UK's primary schools. You can read more about what they found out on our website at <http://www.bbc.co.uk/guides/zq3hxfr>

**We hope this inspires you and your students to get scientific!**

The Terrific Scientific Team

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# What will the children learn? (England, Scotland, Wales, Northern Ireland)

## Northern Ireland

P90 The World Around Us: Where the major organs are located in the body.

## Wales

P12 The names, positions, functions and relative sizes of humans' main organs.

## Scotland

P270 Body cells and systems SCN2-12a. By investigating some body systems and potential problems which they may develop, I can make informed decisions to help me maintain my health and well-being.

## Science experiences and outcomes

Develop the skills of scientific enquiry and investigation using practical techniques. P259

Apply safety measures and take necessary actions to control risks and hazards. P259

## England

Year six: Sc6/2.2b Recognise the impact of diet, exercise, drugs and lifestyle on the way their bodies function.

## Working scientifically

Planning different types of science enquiries to answer questions, including recognising and controlling variables where necessary. P166

Taking measurements, using a range of scientific equipment, with increasing accuracy and precision, taking repeat readings where appropriate. P166

Reporting and presenting findings from enquiries, including conclusions, causal relationships and explanation of and degree of trust in results. P166



## These activities encourage children to:

- **Develop** observational skills and encourage children to draw simple conclusions from their observations using scientific language.
- **Recognise** the positive impact that exercise can have on their body.

## Health & safety

The physical activities should be done outside. This activity should be risk assessed by the responsible teacher, and the identified control measures must be put in place before any pupil takes part in the activity. Precautions should be taken as they would be in any similar activity lesson run at the school. It is the responsibility of the teacher to manage this activity safely.

### Important!



The physical activities should be completed **outside** and precautions taken in exactly the same way as for a PE lesson.

- Pupils with known medical conditions that could endanger them during exertion, along with those with current acute infections or injuries at the time of testing, should not participate in the physical activities.
- Ensure that children who need them have inhalers with them outside.
- Ensure that all children have tied up their shoe laces.
- Ensure that children requiring an epipen in the case of stings or bites can access help and support quickly.
- Take a first aid kit outside with you, and someone trained to use it.
- Children should be dressed appropriately for the weather – sun-hats and sun cream in hot weather.
- If temperatures exceed those which would allow normal outdoor school PE, then do not do the outdoor activities at that time.
- Children should have access to drinking water whilst outside. However they should place their water bottles away from the IT equipment when they return inside.
- Teachers should also consider pupils who may find these activities challenging. These activities should be fun and enjoyable but some pupils may not be comfortable doing physical activity in front of others. Normal considerations should apply.

# Investigating Exercise

## Introduction



We have known for some time that exercise is good for you, and lots of teachers say that they have found short bursts of exercise are good for pupils' concentration. Because of this, many schools across the UK are beginning to do a daily 15 minute burst of exercise on top of PE lessons and activities at break time. When this investigation originally took place in 2017 there was little scientific evidence to support the idea that these short exercise bursts improve concentration. Classes all around the UK took part in collection data to send to a team of scientists at universities in Edinburgh and Stirling to help them with their research on the impact of exercise on pupils' cognition and mood.

However, it's not a very straightforward question to answer, because so many things might make a difference. Although the study with Edinburgh and Stirling is now closed, you can use the following investigation to find out what impact exercise can have on your class's cognition and mood.



# Teacher Preparation

## Expected duration:

Around sixty minutes per day on three separate days. (Days do need to be consecutive.)

## Resources

- Stroop Test and Answer Sheet
- Audio equipment (e.g. mobile phone, laptop with speakers).
- Bleep test audio recording (provided on our website).
- Distance measuring equipment for 20 metres.
- Tape / chalk / playground cone markers.
- Data recording sheets (provided on our website).
- Timer / stopwatch.
- PE kit is not required, but children may wish to change in to running shoes / trainers.



## The children will:

1. Answer the mood questions, and take the Stroop test.
2. Do one of the outdoor activities: either the BLEEP TEST, OWN PACE RUN / WALK or CONTROL activity. Over three days, it is really important that the children complete all of the three outdoor activities. The control activity is needed to allow children to compare how the two different exercise types affect them.
3. Directly afterwards, answer the questions about their mood and do the Stroop test again.

You are free to choose the order and on which days the outdoor activities are completed.

Each session follows the same pattern:

<b>Day 1</b>	Mood Questions/ Stroop Test	Outdoor Activities	Mood Questions/ Stroop Test
<b>Day 2</b>	Mood Questions/ Stroop Test	Outdoor Activities	Mood Questions/ Stroop Test
<b>Day 3</b>	Mood Questions/ Stroop Test	Outdoor Activities	Mood Questions/ Stroop Test

# Main Activity



## Step 1. Mood questions and Stroop Test

**Expected duration:** 30 minutes for the first session including demonstration, then 15 minutes thereafter.

In order to measure the effect of the different types of activity, each child will answer a few questions about how they feel and complete an attention or memory ‘game’ called the Stroop Test. They need to be completed as close to starting the physical activity as possible.

### Ask:

How do you feel right now?

How awake do you feel right now?

### Mood questions:

Show the class a copy of the Feeling Scale and the Awake Scale (available at the end of this pack). Explain that the facial expressions are used to represent a scale of “very bad” to “very good” and very sleepy’ to ‘very awake’. Check that they understand how to use the scales to answer the questions “How do you feel right now?” and also “How awake do you feel right now?”

## Attention and Memory task: ‘The Stroop Test’

### Background

The Stroop effect is named after the scientist who discovered it: Dr John Ridley Stroop. In 1935 he was investigating how the brain works when he noticed something strange. For one of his investigations he was asking people to read a list of words. The list he gave them was a list of colour words but they were printed in a different colour from what they meant, e.g. **RED** or **GREEN**. People had no problem reading just the words but when Dr Stroop asked them to say the colour they were printed in they found it really hard and kept saying the word not the colour! This is called the “Stroop Effect”.



Dr Stroop's investigations showed that when we know how to read a word we do it automatically. This is because we practise reading words every day so we get really good at it and eventually we don't have to think about it. Try looking at a word you know really well – like your name – you'll see it's impossible to stop yourself from reading it and understanding the meaning. Scientists aren't complete sure on the exact reasons why the Stroop effect happens but they think when you try to do the Stroop test you automatically read the word which interferes with being able to name the colour of the word. This means your brain has to work a bit harder to process and sort out the correct information, which slows down the time it takes to say the right answer!

### The website:

Check out the student resources on the Terrific Scientific website:

<http://www.bbc.co.uk/guides/z8pqrxw>

### You will Need:

- A stopwatch or timer per pair
- A Stroop Test and Answer Sheet per pupil. (Numbers on the sheets will help you match answers to the test)
- Student recording sheet (in the Student Resource Pack)

### Preparing the Stroop test.

We have provided 3 versions of the Stroop test at the bottom of this pack. Each test is a single page with a 6x6 grid of words in various colours. Each test has a matching answer key that is just in black.

When printing out the sheets remember to use coloured ink and print each test on a single page, not double sided.

### How to use the tests

- Print out copies of the tests so there is enough for one test per pupil. Pupils will also need a copy of the corresponding answer sheet
- Hand out the tests randomly to each pupil
- Pupils will use the same test before and after the chosen activity for the day.
- Collect in the tests and answer sheets when you have finished with them for the day – you can re-use them each day.

## The Test - Instructions

Everyone will take turns being timed doing the test. Students will have a list of words in different colours and they have to say the COLOUR that the words are printed in out loud, not say the words, as fast as they can.

Example:

For **RED** students should say blue not red. For **BLUE** students should say yellow not blue.

This test is really tricky to do, people always get one or two wrong – and that's OK, it's even expected! If students get one wrong they need to say the right colour before moving on to the next word. Once all the colours have been correctly identified the timer will be stopped and the time will be recorded.

The test should be repeated **three** times each and the average time calculated. You should do this before and after each activity so you can compare the results.

- Split into pairs (or small groups) and chose a role.
  - Student 1 will take the test first
  - Student 2 will keep time and check Student 1 has given the correct answers (in smaller groups these tasks can be shared)
- Students should swap their test sheets with each other but keep hold of their original answer keys.
- Once Student 1 has the test sheet in front of them they are ready to start.
- Student 2 should say “go” and start the stopwatch/timer at the same
- Student 1 then says the ink COLOUR not the word written down as fast as they can, reading through the test sheet from left to right.
- Student 2 should use the answer key to check that Student 1 is saying the right colours. If any colour is said wrong it should be corrected by Student 1 before they can proceed to the next one.
- When Student 1 has correctly said all the right colours in the right order student 2 should stop the stopwatch/timer.
- Record how long it took Student to do the test.
- Student 1 should repeat the test two more times for a total of 3 attempts
- Students should then swap roles so Student 2 is now taking the test and Student 1 is recording the time.

## Alternative to the Stroop Test

### Object Memory Game

This test is an alternative to the Stroop test, that can be used to test your memory. **You do not need to complete both tests.**

You should only use the same test through out the investigation. If you do a different test on different days your results will not be comparable.

#### Tip:

You may wish to do a few 'test runs' of this test to adjust it for your class. If it is too easy add more objects or reduce the time given to observe and recall the objects. If it is too hard remove some of the objects or increase the time given to observe and recall.

#### You will need:

- Around 15-20 different recognisable objects from the classroom (such as pens, paper-clips, books etc.).
- A tray or desk large enough to hold the objects.
- A tablecloth or sheet large enough to cover all the objects.
- A stopwatch or timer.

#### Method:

- Set up the objects in an area that is visible for all your pupils (try to avoid letting them see which objects you have selected)
- Cover the objects with the cloth and have the students gather around.
- Uncover the objects and allow the children 1 minute to try to memorise as many as they can.
- Re-cover the objects and give your pupils 1 minute to write down as many objects as possible.
- Uncover the objects again and go through each one. Pupils should give themselves one point for each object they correctly remember.

Repeat the test two more times. Try to vary the position of the objects, and exchange some with different objects so students aren't just memorising the answers.

## Step 2. Outdoor activities

Immediately after the mood questions and the Stroop test have been completed, the class should then perform one of the three outdoor activities described below. All activities should take place as part of class time and **outside**. The intention is that these activities are performed additionally to usual PE or break time exercise.



### Tip:

It is a good idea to practice the bleep test with the children before you attempt the investigation.

### 1. Own pace run / walk (15 minutes)

This is a 15 minute walk or run outside. The children do not need to change in to their PE kit for this activity. Wheelchair users can join in this activity

- a) Tell the class the experiment is to go outside to do an activity for 15 minutes. You should explain that this is not a race or competition, and is meant to be fun, so the children are free to run, walk, wheel, and move about at their own speed. However, pupils should be encouraged to put in as much effort as they can. They are free to talk to other people in the class while they do this.
- b) Once the 15 minutes are finished, end the task and return to the classroom and complete the mood questions and Stroop test again.

### 2. Bleep test (approx. 30 minutes)

This is a shuttle run; commonly known as the “bleep” test and should be performed **outside**. Runners continuously run back and forth between two lines, 20m apart, in time with a recorded audio signal (bleep) occurring at set intervals.

- The runners should aim to pace themselves to reach the target line at the bleep (not before or after).
- As the test progresses, the interval between the bleeps decreases, forcing the runners to increase their pace to keep up.
- If the line is reached before the bleep, runners must not start to run for the other line until after the bleep.
- Runners continue with the test until they are no longer able to reach the target line in two consecutive tries before the bleep sounds. The last successfully completed shuttle is the one recorded; this is the pupil’s final score.

### Remember:

Make sure the children realise that they do not need to run as fast as they can; the bleep test is about **how long** they can keep up.



### Tip:

Use a click wheel if you have one, or a tape measure to mark the course ahead of the lesson if possible.

- Each test should take between 2-10 minutes to complete, with approx. 3-4 minutes for a demonstration and pre-test instructions.
- With children working in pairs and swapping roles (one runner, one recorder), you should only need to run the bleep test twice to allow all children to complete the test.

The aim of the bleep test is to make children exhausted, as this is one of the conditions of the study.

Method:

- Get the children into groups of two. One person will run and one person will record the shuttles completed by the runner. Ensure that each scorer has a score sheet and pen. The job of the scorer is to mark a tick on their sheet each time the runner completes a shuttle (1 x 20m length).
- Create the running area on a suitable, flat surface by marking two parallel lines 20m apart. Lines can be made with tape/chalk or with cones. Lines should be long enough for all the runners to stand on comfortably side by side. The running area needs to be a 20m straight run, it cannot be split into two 10m runs.
- The teacher should start the audio recording and ideally run two or three lengths to show how to stay in time with the bleeps, when to run and, finally, how to recognise when a level has not been successfully completed.
- Line the runners up.
- Ensure the recorders have a clear view of the runners. Each recorder ticks off the shuttles as they are completed by the runner, taking a note of when each runner fails to complete a shuttle with a cross. When the runner misses a bleep the recorder tells them. When they miss two bleeps in a row the runner retires to the side. Their run is over and the recorders note at which level and shuttle the runner stopped running.
- Allow the children a small break to catch their breath (but remember you need to complete the mood questions and Stroop test again as soon as possible, so don't let them rest for too long!). Then have them swap places, so the runners are now recording the second group, and repeat the test.





### Remember:

It is important that as soon as the whole class has finished the bleep test, they complete the mood questions and Stroop test without delay.



- g) Children who finish first should be encouraged to cheer on the children who are still running.
- h) Now return to the classroom and complete the mood questions and Stroop test again.

**Non-audio signals can be used for children with auditory processing issues or hearing impairment e.g. raise a flag at the same time as the bleep.**

### 3. Control activity (15 minutes)

This activity involves the class simply sitting (ideally) or standing outside for 15 minutes. This activity sets a baseline to measure the impact of the other activities against.

- a) Explain to the class that this activity doesn't involve doing any physical activity at all, they are just going to sit outside for 15 minutes. They can chat with other classmates, or the teacher may want to lead group discussions during this time.
- b) Take the children outside and have them sit or stand for 15 minutes. They can be allowed to talk and chat but not take part in activities like reading a book or playing games.
- c) Once the 15 minutes is over, return to the classroom and complete the mood questions and Stroop test again.

## Step 3. Repeat mood questions and Stroop test

- 1. **As soon as possible** after completing the outdoor activity, the children should repeat the mood questions and Stroop test, within a maximum of 20 minutes.



### Discussion:



Ask children to think about what they have just observed and how they felt.



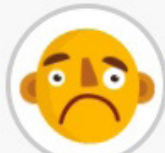
## Review - Discuss with your class

- How do you think the exercise affected your body?
- How do you think the exercise affected how you feel?
- How do you think the exercise affected your levels of concentration in class?
- Which type of activity did you prefer?
- Which type of exercise do you think was most beneficial for you?
- Did your score on the Stroop get better? Why do you think that happened? Which do you think was most beneficial in helping you to improve? Do you think the exercise was more beneficial for your score or doing the practice games made more impact? How could you test your idea?



# 1 How do you feel?

How do you feel right now?



Very bad



Bad



Fairly bad



Ok



Fairly good

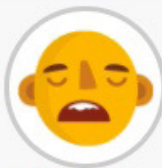


Good

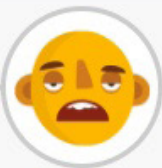


Very good

How awake do you feel right now?



Very sleepy



Sleepy



A bit sleepy



A bit awake



Awake



Very awake



## Stroop Test - 1

BLACK	RED	RED	RED	BLACK	RED
BLACK	RED	BLUE	BLUE	BLUE	RED
RED	BLUE	BLACK	RED	BLUE	BLACK
RED	RED	RED	BLUE	BLUE	BLUE
BLUE	BLACK	BLUE	GREEN	GREEN	GREEN
BLUE	BLUE	RED	BLUE	BLUE	BLACK



## Answer sheet - 1

blue	red	blue	black	blue	black
black	black	blue	blue	black	blue
blue	blue	green	black	red	red
green	black	blue	black	red	black
red	red	black	black	black	red
green	red	green	green	black	blue



## Stroop Test - 2

GREEN	RED	BLUE	GREEN	RED	RED
BLUE	BLACK	RED	RED	GREEN	GREEN
RED	BLACK	GREEN	RED	RED	BLACK
RED	GREEN	RED	BLUE	GREEN	BLACK
BLUE	GREEN	BLACK	RED	RED	BLUE
GREEN	BLACK	GREEN	BLACK	RED	BLUE



## Answer sheet - 2

black	green	black	blue	black	blue
green	red	black	red	red	red
red	blue	blue	green	green	blue
black	green	green	red	green	green
blue	black	red	black	red	green
blue	blue	red	blue	black	green



## Stroop Test - 3

RED	GREEN	GREEN	BLUE	BLACK	BLACK
BLUE	GREEN	BLACK	RED	GREEN	GREEN
RED	BLACK	BLUE	GREEN	BLACK	GREEN
BLACK	RED	RED	BLACK	BLACK	GREEN
BLACK	BLUE	BLUE	GREEN	BLACK	GREEN
RED	GREEN	RED	BLUE	RED	BLUE



## Answer sheet -3

green	blue	red	green	green	red
red	red	black	red	black	black
black	blue	blue	black	red	green
green	black	red	black	green	red
red	red	blue	green	black	black
blue	blue	red	blue	black	blue