The Royal Institution
Science Lives Here

A New Revolution

Teachers' notes

8–11 year olds

Lecture 3 of 3: Sparks Will Fly: CHRISTMAS LECTURES 2014

A revolution is happening. Across the world people are taking control of the devices we use every day, customising them, creating new things and using the sparks of their imagination to change the world. Can we turn a humble motor into something world changing?

Context

Many everyday items rely on an electric motor to improve their ability to do the task that they are designed for. Think about hand held devices such as the drill, the screwdriver, the fan, the toothbrush, the whisk and the list goes oné .. Most children make the link between the basic tool and electricity making the tool better but this lesson seeks to introduce the new term and awareness of the electric motor. Children are then encouraged to consider the process of invention and take a simple device and improve it with a motor.

Children will be able to work scientifically by:

Identifying and Classifying:

- Making comparisons between simple features of objects
- Communicating scientifically to persuade others of technological benefits

Children will learn:

- That many objects use electricity to improve their usefulness
- Motorised objects or robots are changing the way we do things in the future.

Cross curricular opportunities:

- Persuasive Argument and Reflective Evaluation

Resources suggested

Electric whisk, manual whisk, two bowls, two egg whites, stopwatch (x2)

Coffee stained white tiles old electric toothbrush, standard toothbrush

Rubikôs cube

Lesson Outline - summary

Starting the lesson

ÅA quick quiz. Pupils are shown four pictures and think about the common theme across the random objects. New clue pictures reveal that all the objects can be motorized. Most pupils will describe the electric plug and the term motor may remain unknown at this stage.

ÅPlay on words. Pupils shown a scrambled word and use picture clues to unscramble. The activity introduces the common everyday use of the term motor. The additional challenge is to consider where motor is used and does not mean a motor! See motorway. The term robot is often used for an object that is motorized to do a job.

Main activity

ÅInvention and design. Pupils work in groups to invent a new object that uses a motor. Support sheets available to structure the groups.

ÅPersuasion and communication. Pupils create an advert for the new invention and present a funding bid to an expert panel see also popular TV such as *'Dragons Den'*. The panel could be invited guests such as a governor or parents, or pupils panel taking a role.

Plenary

ÅReflection: Pupils think about the potential of motors today and also into the future. 3D printing means that manufacturing costs can be greatly reduced so in the example of the prosthetic hand a new replacement can be made easily as the child grows, the hand can be made at home by the parents (in any colour!)

Lesson outline - detail

Slide 1: Four images of everyday objects. *What do they have in common? Which is the odd one out?* Note: The objects can all be motorised. Some items when motorised do a job better than a human, some items when motorised are used for fun.

Slide 2: Pupils to experience just how much easier a motor can make a simple task. Challenge two pupils to compare how much faster to a hand whisk an egg white compared to electric whisk. Challenge a further two pupils? Do electric toothbrushes remove more stain than a standard toothbrush? Compare them in a timed exercise on coffee stained tiles. Work towards establishing the new term for pupils **The MOTOR.** **(***Alternative muscle vs motor challenges might include e.g. Hand held whisk vs electric whisk to whip an egg white* ***or*** *blowing bubbles vs a bubble machine* ***or*** *sailing boat fanned across a bath vs a battery fan.*)

Use the video http://bit.ly/xmasP3: Challenge the class to solve a Rubikôs cube, then show them the video of the Cubestormer solving it in record time!

Slide 3 Word scramble: a simple quick fire whiteboard show and share game with each word revealed separately. Establish the new term ómotorô Think about how a motorway might be different to how we know it now. Introduce the robot as a motorized object. Robots are items with several motors that can be controlled.

Slide 4 Task to invent something to make life easier/ better for someone? Pupils take on the role of an entrepreneur with a new invention, trying to pitch their concept to investors for funding. Pupils in groups devise an advert for a new product that includes a motor that can be pitched as a two minute persuasive presentation to a panel. Pupils in role as innovators and evaluators. Pupils take on the role of a panel member and draft questions to ask as an investorô Panel to consist of Michael Faraday (a face of past scientists) Danielle George (a face of current scientists) and the class (the faces of future scientists). Use the Pupil Help Sheet at the end of this document.

Slide 5: Reflect upon how important motors can be. Build empathy with the case of Hayley Fraser the Scottish five year old who is now able to use a prosthetic arm made from a 3D printer. The 3D printer reduces costs, allows a new hand to be made as and when needed as Hayley grows and can be made in her home. Leave pupils with a sense of awe that motors are marvelous.

Homelink A chat challenge: If a motorway was actually a motorway what would it look like? Would there be any advantages? Do you think there might be motorised ways in the future?

Websites

Clip link: http://bit.ly/xmasP3

The CHRISTMAS LECTURES can be found at: http://bit.ly/1xg9CUg

Teacher Science Background knowledge

Pupils are NOT expected to know how the electric motor works but that the existence and invention of the electric motor has had a dramatic effect on everyday objects and consequently quality life experiences.

It is in line with KS4 that the curriculum requires awareness of the electric motor process and the effect of magnetism and electrical current in causing movement. See for more information. http://bbc.in/1LgL2xa

However a great and easy activity as included in the lecture is the making of a simple motor from a battery a magnet and a coil of wire, a real must for science clubs. See http://bit.ly/15NWrU8

Hayley Fraser and her 3D printed hand, in the news http://bbc.in/169TT33

A great range of books to accompany the CHRISTMAS LECTURES, consider for your library corner. http://bit.ly/18ts5sc

For more primary science lessons with a topical theme see http://bit.ly/1zazXHw

Pupil HELP SHEET

Task 1

Imagine you are an inventor

- Use your scientific knowledge to invent a **new motorised** object.
- Think about the **need** for the product and how much **better** a motor can make the experience for the user.
- Make an advert to promote your new object. Be ready to promote your new invention to a Dragons Den.
- Will the expert panel approve your ideas?

Your teacher will tell you the challenge that you are to complete

Each group to consider **one** of the following

Group A: Invent a new product to help with pet-care

Group B: Invent a new product to help the elderly.

Group C: Invent a new product that will help with looking after a baby

Group D: Invent a new product that will be used in the home

Group E: Invent a new product that can be used in the garden

Group F: Invent a new product that can be used in the classroom

Group G: Invent a new product to use in an area of medical emergency

Task 2

Imagine you are part of a decision making expert panel

Your teacher will tell you who you are to be

- Michael Faraday (the scientist who first made the motor move)
- Prof Danielle George (the engineer who gave the Scientific Christmas lecture in 2014)
- 21st Century Citizen (you in ten years time)

Write two questions each that you can ask the inventor
Listen and think about the inventor and the ideas
Decide as a team if you think the invention should be manufactured or not.
You must be able to give a reason for your decision.
ðThis is a good invention becauseé é é é .ô
ðThis is not such a good idea becauseé é é ..ô
ðWe think this becauseé é .ô