Introduction

Project Vision

Vision
The vision of this project is to re-imagine science education in primary schools through activity based learning.

Activity Based Learning
This resource will address the four main modules of primary level science. This project only includes a completed version of the Physical World module. The completed module will be a template for the development of the other three modules.

Learning from Junk
The main principle of this project is to reuse existing materials and components that are easily accessible. The focus for this project was what can be made from the components that make up a standard computer hard drive and how they can be used to educate primary level students.

Health and Safety

Dismantling a Hard Drive

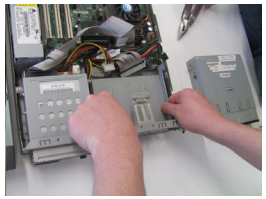
Tools required:
Torx Screwdriver, sizes 8, 9, and 10
Phillips Screwdriver

Before dismantling ensure that the power has been disconnected from the computer for at least one day.

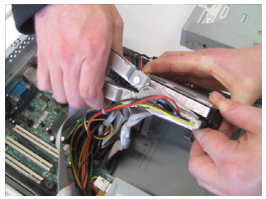
At the back of the computer unscrew these two screws. Be wary of small pieces.

Carefully remove the computers protective casing.

Remove the CD drive from the case by disconnecting the data and power cables at the back by pulling it out.

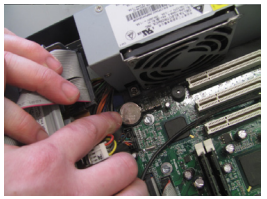


Remove the metal cover that is obscuring the hard drive. Be careful of sharp edges.

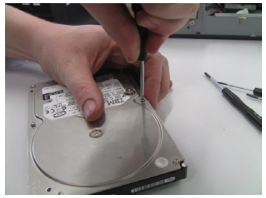


Remove the hard drive from the case by disconnecting the data and power cables from the back and lifting it out.

At this point, both the CD drive and the hard drive should have been removed from the computer case.



Warning. Somewhere on the motherboard should be a battery which contains toxic chemicals.



Remove the screws from the back of the hard drive to open it up.

Carefully pry away the top magnet. Be careful, it will destroy electronics.

Remove the screws on the top of the bearing, take off the disks and remove the bearing.

Remove the circuit board and the screw indicated to access the second magnet.

Magnetism Plan

Focus Strand: Magnetism

Specific Learning Outcomes: *How magnets work?*
The aim is for students to understand what kinds of materials are magnetic, and why they are attracted to magnets; be able to describe how magnets attract and repel, and understand magnetic fields.

Key Ideas and Activities:
Materials that are most commonly attracted to magnets contain ***iron***; which happens to be the most common material used to make magnets. Not all metals are magnetic like ***copper***, and things such as wood and plastic aren't either. Magnets tend to be made from steel ***alloys***.

Activity One:
Magnets are produced in various shapes and sizes, the three most common being the ***horseshoe, bar and ring magnet***. Each magnet has an end that repels and one that attracts other magnets.

Give the students a magnet each and a collection of magnetic and nonmagnetic materials. Get them to divide the materials that are magnetic and the materials that are not magnetic into two piles. Prompt the students as to why some materials are atracted to magnets and some are not.

Activity Two:
All magnets produce a ***magnetic field***. This means that their magnetism can be felt at a distance radiating from the magnet. The strength of the magnetic field decreases ***exponentially*** as the distance from the magnet increases. The magnetic field is experienced in all directions around the magnet.

Give the students a horseshoe, bar and ring magnet. Have them place the magnets on the sides of the plastic container filled with iron filings and corn syrup. Note how each magnet creates a different pattern of filings.

Activity Three:
There are magnets mounted on the front and back of the two cars. Let the students play with them and find out which pushes or pulls the other. Prompt the students to try and make the cars move without the magnets touching or use different magnets to see what happens with cars speed.

Teaching Resources

Physical
Horseshoe, Bar, and Ring Magnets.
Magnetic and nonmagnetic objects.
Magnetic cars.
Plastic container filled with cornsyrup.
Container of iron filings.

Online

How magnets work:	*http://www.howstuffworks.com/magnet.htm*
	http://www.howmagnetswork.com
Magnetic field:	*http://www.youtube.com/watch?v=uj0DFDfQajw*
	http://www.youtube.com/watch?v=wuA-dkKvrd0
Like poles repel:	*http://www.youtube.com/watch?v=Vj04A3n_VDM*
Electricity & Magnetism Hand Rules:	*http://www.youtube.com/watch?v=9Zy0VHBXxLU*

Lexicon

Alloy:	A metal made by combining two or more metallic elements.
Bar magnet:	A straight magnet.
Copper:	A red-brown metal, that is very good at conducting electricity and heat.
Exponential:	An increase or decrease at a faster and faster rate.
Horseshoe magnet:	A horseshoe shaped magnet.
Iron:	A strong, hard silvery-grey metal that is also magnetic.
Magnetic field:	The region around a magnetic material, where atraction or relusion takes place.
Magnetic:	Capable of being attracted by a magnet or acquiring the properties of a magnet.
Ring magnet:	A disk or flat shaped round magnet.

Electricity Plan

Focus Strand: Electricity

Specific Learning Outcomes: *How does electricity work?*
The aim is for students to be able to define how a circuit works and describe the components needed to create a circuit.

Key Ideas and Activities:
Some materials will allow electricity to flow through them. These are mainly metals, however some exceptions exist such as graphite. We use ***batteries*** and ***generators*** to create electricity to be used. Materials that slow the flow of electricity are call resitors.

Activity One:
Electricity can be used to power a ***light bulb***. The bulb generates light by resisting the flow of electricity. If light bulbs are put in ***series circuit***, they will get dimmer as more are added because they each bulb creates resistance. If the lights are put in ***parallel circuit***, they will be similarly bright as the share the electricity between then evenly.

Provide students with a drinking straw, labelled positive and negative at each end and a small bag ball bearings. With their finger over the negative end, have them fill the straw with bearings. Place the filled straw flat on the desk and push another bearing into the straw. What happened and why?

Activity Two:
Electricity is the voltage created by a battery. The voltage pushes the electricity around the circuit and makes lights light up. A simple way to understand this is to push ball bearings through a drinking straw. The amount of push is the ***voltage***, the size of the tube is the current and the bend of the straw is the ***resistance***.

Provide students with a battery, a light and copper wire. Help them to assemble these into a basic circuit. Use different materials in the circuit to vary the flow of currant. Use the variation in the light bulb's brightness to understand how each material affects the flow of electricity to the light bulb.

Activity Three:
Provide the students with the necessary components in order to create some simple circuits. Motivate the students to construct a circuit with one bulb. After successfully completing this goal stimulate the students to try various combinations of parallel and series circuits using different bulbs.

Teaching Resources

Physical
Drinking straws
Bags of small ball bearings
Electrical Alligator Clips
Resistors
Multimeters or Voltmeters and Ammeters
Assortment of Bulbs (L.E.D, Halogen, Incandescent, Tungsten)

Online

Circuits types:	*http://www.youtube.com/watch?v=Uj2SJHGtZ78*
	http://www.youtube.com/watch?v=3o8_EARoMtg&NR=1
	http://www.youtube.com/watch?v=ONRw2VZf6VI
Series circuit:	*https://www.youtube.com/watch?v=aysOw7h3zg8*
Series & :	*https://www.youtube.com/watch?v=iiTSRxJi4nw*
parallel circuit:	*https://www.youtube.com/watch?v=apHkG4T6QHM*
Lightbulbs:	*http://www.youtube.com/watch?v=YnMP1Uj2nz0*

Lexicon

Battery:	A container consisting of one or more cells, in which chemical energy is converted into electricity.
Circuit:	A complete and closed path around which a circulating electric current can flow.
Generator:	An machine that generates electrical power.
Light bulb:	A glass bulb that provides light by passing an electric current through a pocket of inert gas.
Parallel circuit:	When electrical components or circuits connected to common points at each end, rather than one to another in sequence
Resistance:	The degree to which a substance or device opposes the passage of an electric current.
Series circuit:	When electrical circuits or components arranged so that the current passes through each successively. The opposite of parallel
Voltage:	An electromotive force or potential difference expressed in volts

Bearings Plan

Focus Strand: Bearings

Specific Learning Outcomes: What are bearings and how do they work?
The aim is for students to be able to identify different types of ***bearings*** and describe how they are used to reduce friction and make movement easier.

Key ideas and Activities:
Bearings help wheels, axles and other parts rotate smoothly. Bearings aid movement by preventing parts from rubbing against each other. When two or more objects rub against each other, there is ***friction*** between the surfaces wnich may cause noise and heat.

Activity One: *Bicycle wheel bearings*
Take apart a front bicycle wheel. Observe how the bearings help the ***axle*** to move smoothly inside the wheel ***hub***. Notice how the grease helps the bearings move freely.

Activity Two: *Heat and noise*
Outside, give each pupil a piece of wood and few different pieces of sandpaper. Have the rub the piece of wood with each piece of sandpaper and find out why it is easier to sand with some pieces than with others. How noisey is the whole process? Now do the same test, but rub each piece of sandpaper really fast to see how hot they get. Which piece got the hottest and why?

Activity Three:

Teaching Resources

Physical
Pieces of wood
Different grades of sandpaper
Old front bicycle wheel.
Adjustable spanner
Paper towels

Online

Bearings:	*http://www.youtube.com/watch?v=RihQOUNsN9c&NR=1*
	http://www.wisegeek.com/topics/axle-bearings.htm
Axle:	*http://www.youtube.com/watch?v=7N_drdBrNMU*
	http://uk.ask.com/question/what-is-friction-how-do-you-explain
Friction:	*http://www.wisegeek.com/what-is-an-axle.htm*
	http://www.youtube.com/watch?v=GpBv-wkxc-M

Lexicon

Axle:	The round shaft that a wheel rotates around or on.
Bearing:	A part of a machine that bears friction, usually between a rotating part and its housing. eg Wheel axle and wheel hub.
Friction:	The difficulty you experience when rubbing two things together.
Fuel:	Something that can be burnt or used to make machines do things.
Hub:	Central part of a wheel, rotating on or with the axle, and from which the spokes radiate.

Construction Plan

Focus Strand: Construction

Specific Learning Outcomes: *How are materials joined together?*
The aim is for students to be able to identify what ***materials*** and ***joining processes*** have been used to ***construct*** objects from the environment surrounding them.

Key Ideas and Activities:
In our world objects are assembled out of various parts. A desk, a car, a house, are all contructed using different methods of ***assembly***. Some of theses methods could be using ***adhesives, fasteners, wooden joints, constuction joinits, welding*** or any combination of these.

Activity One: *Adhesives*
Adhesives chemically bind two materials together. Adhesives can be weak if they are not used with the correct materials. The materials may need to be held together with a clamp while the adhesive dries to aid bonding.

Glue 2 pieces of the same material, and 2 pieces of different material together. At the end of the lesson, test which join worked and which failed and ask the students if they know why.

Activity Two: *Fasteners*
Nails and screws; dowels, bolts and rivets; cable ties and wire are all examples of fasteners. Screws and nails can be driven into wood, or metal. Dowels, bolts and rivets need to be threaded into or through a hole. Cable ties and wire are used to tie or thread together objects.

Use two pieces of wood and hammer them together with a nail. *Be careful to bend over the nail if it is protuding.* Test the strength of the join, add more nails and re-test. Use screws instead of nails and compare the joins.

Activity Three: *Joints*
Two parts can be attached by making them interlink. These interlinking shapes are what create the joint and hold the parts together. Puzzle pieces or a finger/comb joint are examples of joints.

Teaching Resources

Physical
Pieces of wood
Hammer
Screwdriver
Adjustable spanners
Assorted nails, screws, and bolts
Wood glue

Online

Glues:	*http://home.howstuffworks.com/glues.htm*
Wood Glue:	*http://home.howstuffworks.com/wood-glues.htm*
Adhesive:	*http://en.wikipedia.org/wiki/Adhesive*
	http://www.ehow.com/how-does_4587756_glue-work.html
Hammer:	*http://home.howstuffworks.com/hammer.htm*
How to use a hammer:	*http://www.popularmechanics.com/home/improvement/4217164*
Saw:	*http://home.howstuffworks.com/handsaws.htm*
Wood Joints:	*http://www.raygirling.com/wwjoints.htm*
	www.the-warren.org/GCSERevision/resistantmaterials/woodjoints.htm

Lexicon

Adhesive:	A substance used for sticking objects or materials together.
Assembly:	The process of fitting together of parts to create a single object.
Bond:	To join or be joined securely to something else
Consruct:	To build or form.
Fastener:	An object used to join or affix two or more objects together.
Join (joint):	To fix and hold together, two or more materials, in a way that they could be considered a single object.
Material:	The matter from which a thing is or can be made.
Welding:	A process that joins together pieces or parts of metal or other materials by heating the surfaces to the melting point, and uniting them by pressing, hammering, etc.

Joshua Ureli Sian Foster Guy Hopley Troy Croudis Brian Smith Eleanor parker Jake Izuchi