Primary Science & Technology Bulletin

Ideas & inspiration for teachers in Primary Schools & S1/S2

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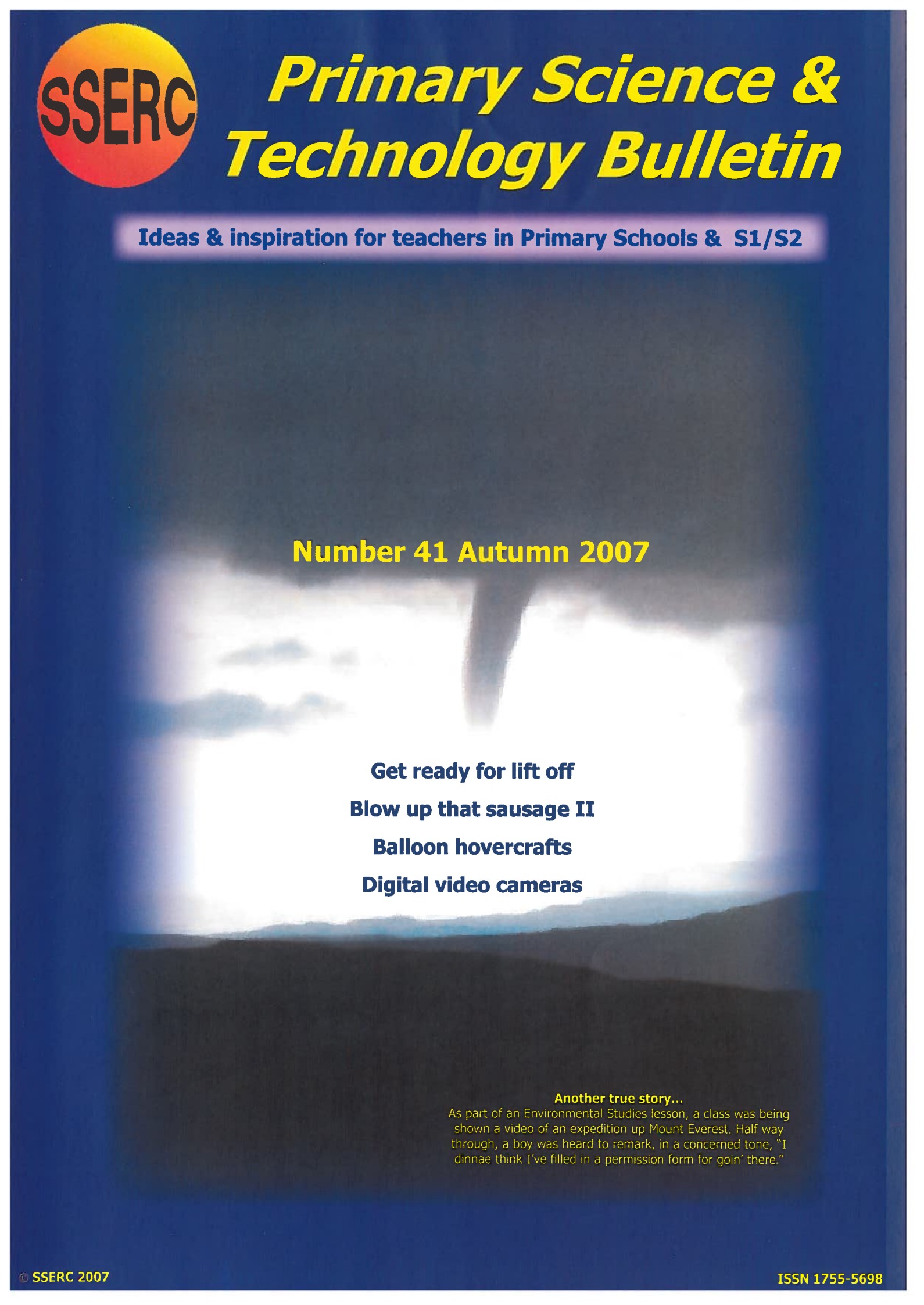

Get ready for lift off

Blow up that sausage II

Balloon hovercrafts

Digital video cameras

Another true story...

As part of an Environmental Studies lesson, a class was being shown a video of an expedition up Mount Everest. Half way through, a boy was heard to remark, in a concerned tone, "I dinnae think I've filled in a permission form for goin' there."

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Up, up and away

Cover photo (Figure 1) - Tornado in Scotland taken by Graeme Paterson, SSERC's Network Manager, from the summit of Cruach Bhuidhie, Glenbranter, Argyllshire, Grid Ref: NS125947

Find our more about tornadoes at http://www.spc.noaa.gov/faq/tornado/

Figure 1 - Tornado in Scotland.

Introduction

We continue the theme of 'The Air' from Primary Bulletin 40 (Summer issue) with a little more 'gas and air' which we hope will enlighten your classes after the summer break! We look at fizz-pop rockets, sun-powered sausage balloons, balloon/CD hovercrafts and finally, the use of inexpensive digital video cameras in the classroom.

Get ready for lift-off

The main ingredients of effervescent vitamin C tablets are citric acid, sodium bicarbonate and calcium carbonate. This provides an ideal "fuel source" for a fizz-pop rocket. If possible use a 35 mm film canister (Figure 2). Break a vitamin C tablet into quarters and blu-tac one quarter to the inside of the lid. Fill the film canister about one-third full of water. Attach the lid. Remember to wear eye protection.

Figure 2 - Film canister & fuel source.

Invert the canister and place on a flat surface. The water will react with the tablet causing the release of carbon dioxide, the pressure of gas will build up and it will eventually blow the canister body away from the lid. Children can make and decorate paper rockets before attaching them to the film canister fuel cell. See the NASA website for ideas -

www.nasa.gov/audience/forkids/activities/A_Pop_Rockets.html

You can investigate any change in performance of the rocket (time to lift off or height attained) using smaller or larger bits of vitamin C tablet or by varying the volume or temperature of the water..

Why not try videoing the launch process. See the section on using simple digital video cameras on the back page.

Because of the popularity of digital cameras, it is becoming harder to acquire film canisters (ask in your local film developing shop). However, there are adequate substitutes. Vitamin C tablets often come in a tube with a close fitting lid, such as the one in Figure 14. This works very well as a rocket. We have also tried another plastic tablet container and this too was excellent - more patience was required here because it took a much longer time to build up enough pressure inside the container to blast it away from the lid. With these two bigger containers we used a whole vitamin C tablet each time.

Figure 3 - Alternative rocket bodies.

Blow up that sausage II

When gases are heated they expand. On a sunny day we can show this very simply by filling a sausage shaped plastic bag with air, tying the open end and allowing the sun's rays to heat it up. Source of large plastic bags (£13) :-

www.eurocosm.com/Application/Products/Toys-that-fly/solar-airship-GB.asp

After a short time feel the bag and describe any changes. What has happened to the air inside? The bag becomes firmer as the warmed air inside expands and pushes against the wall of the bag.

If the sun is sufficiently strong the bag may even lift off the ground because the warmed air trapped in the bag is at a much higher temperature than that outside. Thus it is less dense and therefore rises.

See a video of "the sausage" in action at :-

http://www.grand-illusions.com/images/articles/toycollection/solar_balloon/solar_balloon.wmv

Figure 4 - One big sausage.

Riding on a Cushion of Air

This model, shamelessly pinched from a children's TV programme, is a fun way to get pupils talking and thinking about the force of friction.

Making the Hovercraft

Stick a sports bottle top (the sort that can be popped open) over the hole in an old CD. We used a low-melt glue gun but also found UHU "White Tack" strong enough. Close the bottle top. Inflate a balloon and stretch it over the top.

Place the hovercraft on a smooth, flat surface. Pop open the top and give the model a push. It should slide freely.

Figure 5 - Here's one I made earlier. A balloon hovercraft.

Health and Safety

It is quite acceptable to allow children to use glue guns provided that there is close supervision, particularly if hot-melt guns are used. Though not quite as effective, low-melt guns are inherently safer. As an aside, glue guns should only be bought from reputable suppliers. There are some cheap but electrically suspect devices out there. Balloons should not be shared for hygiene reasons, and beware of choking hazards. Balloon pumps are a better alternative if practicable. See www.mypartyplanet.co.uk/acatalog/Balloons_Pumps.html for designs and prices.

Figure 6 - A sports bottle top.

Background

Friction is a force that acts against movement and occurs when one surface moves across another. It arises because even smooth surfaces, at a microscopic level, are covered with peaks and pits (Figure 7). Friction can be lessened by reducing the contact between the two surfaces. This can be done using rollers, ball bearings, oil, grease or, as with our model, a cushion of air.

Figure 7 - Even apparently smooth surfaces are rough at a microscopic level.

Teaching Approach

By the time friction is introduced, the children should know that a force is something that can produce a change in speed, shape or direction. If you then slide a book across a desk, pupils should be able to say that it slowed down- a change in speed- because of a force. Name the force as friction. Some pupils may have heard of friction burns or associate friction with rubbing. Discuss why friction comes about and how it can be reduced. They should appreciate or learn through investigation that a smooth surface (glass) offers a smaller force than does a rough surface (sandpaper). They should be able to offer a fair test method of investigation.

Ask the children where they might previously have seen objects floating on a cushion of air e.g. the pucks on air hockey machines, hovercraft. Watch a robot playing air hockey :-

www.maniacworld.com/Robot-Playing-Air-Hockey.html

Demonstrate the balloon hovercraft. Get them to build one in groups. Ask how the hovercraft reduces friction. You can then ask the "rich" question: "What would it be like coming to school wearing hoverboots?" Pupils should discuss this in groups and feed back. Most groups will get as far as talking about sliding easily along the pavement but may need challenged to come up the idea that it would be difficult to stop once you were moving and indeed starting off would be hard because there would be no grip. These are important concepts because friction is often presented as the "baddie", responsible for wasting energy in cars etc. In fact, we could not walk, cycle or drive without friction. See www.ise5-14.org.uk/members/TSEC/Strategies/Interactive_learning.htm for more on interactive learning using collaborative techniques (TSEC teaching strategies).

Going Further

Balloon hovercrafts can be used for investigative work. One school had a hovercraft race where the models were released one by one down a ramp and the distance they travelled before stopping was measured. It was very tricky to do a scientifically fair test but this in itself raised plenty of useful discussion, with one pupil suggesting that everybody's balloon got the same number of puffs from a balloon pump.

A local authority developed an enterprise challenge based on balloon hovercrafts. Pupils were put in charge of a scientific toy company and told that they were going to be selling the models. Just before the balloon hovercrafts were due to be launched, the story went, a rival company stole the plans. Their challenge was to make balloon hovercrafts that were better, more attractive or more fun than the ones from the thieves' company.

Figures 8a & 8b - This Summer (2007), 32,000 passengers used the *Forthfast* hovercraft service between Kirkcaldy and Portobello, near Edinburgh.

Digital video in primary science classes

Many schools and individual teachers now own digital cameras. This article covers the use of the "video clip" feature found on many of these devices. Note that some cameras are now marketed as "tapeless camcorders", designed specifically for video work. These cameras, such as the *Mustek DV* 5000 and *5300SE* (Figures 10 & 11) and *Sanyo Xacti* (Figure 3) ranges may not offer many more video features than conventional digital cameras but their design makes them easier to use for that purpose. Additionally, they tend to be able to compress video files in such a way that more footage can be stored in their memory. The cameras described here can play back videos either via the small LCD screen or directly through the computer or TV, immediately and without the addition of any extra equipment save for a connecting cable. Alternatively, the clips can remain on the camera or can be transferred to a computer with the supplied software installed, for editing and playback later.

Figure 10 - Mustek DV5000 tapeless camcorder.

Figure 11 - Mustek DV5300SE tapeless camcorder - available for around £60 with 512 Mb of memory.

Figure 12 - Sanyo Xacti tapeless camcorder. Costs around £130.

A great site for 1000's of other video uses is :-

www.wacona.com/digicam.html

Uses

Figure 9 - Knockhill race circuit - a good source of fast-moving footage.

Bringing real world into the classroom

Many teachers now supplement their lessons with still photographs taken on digital cameras or downloaded from the Internet. The increased use of whiteboards and digital video projectors complement the use of these perfectly. Digital video adds another dimension e.g. one teacher visited a wind farm and took video footage, panning around to give the children a better idea of the scale of the site and the relative size of the turbines. This opened up discussion on the impact of alternative energy solutions on the Scottish environment.

Sharing learning intentions or summarising lessons

Video editing software, which is often bundled with the camera, makes it fairly easy to string together a number of clips into a short film. All have the ability to add titles and sound tracks. One teacher used this feature to summarise the key learning points of a 5-14 lesson on forces, interspersing text with film of the children working on a practical activity. The film was shown to the pupils before the next lesson to remind them of the work they had covered.

Reviewing practical work

When practical work is used to challenge the children and open up discussion, it can be useful to have a record of the work to review with them. This has been used e.g. to record the results of a class's investigations on friction. The video clips were projected on to a screen and discussed.

Presenting investigative work

Many teachers are aware that individual pupils have their own preferred learning styles. Similarly, some pupils may be much more motivated if they are allowed to present their work to camera rather than solely on paper. Note that not all digital cameras with a video facility can record sound, though the camcorders mentioned here can do so. The Mustek can record sound files as separate entities so can be used as a digital audio recorder also.

Technical issues

Most digital cameras store video clips as individual files memory or on a memory card. When the camera is connected to a computer, it usually appears as an extra disc drive. The video files can be moved and copied in the usual way or played directly from the camera.

Older computers running *Win98* or lower may require a small file (driver) to be installed to allow camera and the computer to communicate. This is often supplied on a CD with the camera.

There are a number of different types of video file formats. Most computers will play most types. Occasionally, when you try to play a file, the computer will report that it does not have the correct *codec*, the file that decodes a video clip. Some computers download these automatically from the internet. In other cases, you may need to seek help.

File formats play a part when it comes to video editing. Video editors allow you to cut parts out of your clips or put them together with titles and sound tracks. The latest Windows computers come with a free video editor called *Windows Movie Maker*. This is a little limited when compared with packages such as *Pinnacle Studio* or *Ulead VideoStudio* (video editors used in a number of schools) but it is an excellent starting point and is easy to use.

The camcorders mentioned here are simple enough to be used by pupils. The Mustek DV5300SE costs around £60, the Sanyo upwards of £130.

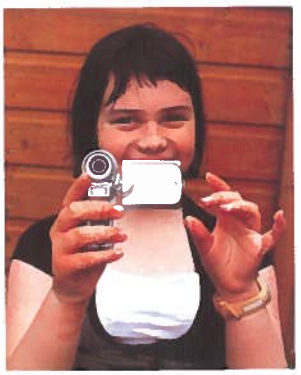

Figure 13 - Digital camcorders are simple enough for children to use.