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Project Report – Supporting KS2 Teachers to Deliver Integrated STEM in Primary Schools

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This project's aim was to help teachers to introduce more STEM (Science, Technology, Engineering and Mathematics) skills into their humanities, arts and science lessons. This was done by creating resources (including lesson plans, PowerPoint presentations and worksheets) that were tested with a year 5 class at St. Mary's Junior School in Cambridge and improving them so that they can be used by every school, no matter what equipment or materials they may have. Teachers are often under pressure to meet targets that the government's national curriculum and the school set out so they may not have much class time to devote to teaching STEM. Resources that 'integrate' STEM into other lessons would really help the teacher be able to meet their targets and do STEM at the same time.

The motivation behind this project is that the UK does not have enough engineers to fill the roles that keep the country growing. It is not clear why the UK's school system does not produce more engineers, but it is expected that it is caused by a range of issues. This includes that many students believe that a career in engineering is nothing more than being a plumber or electrician, but this is far from true. Engineers are not only responsible for building new infrastructure (roads, buildings etc.), but are the brains behind cars, aircraft, electronics, the internet and even medical equipment and devices such as implants and ventilators! Another addition to the equation is the gender divide in the workforce. About a decade ago, only 6% of engineers in the UK identified as women. Since then, this percentage has doubled to 12% and is still growing. By improving the representation of engineering skills and themes in schools, this project hopes to inspire the next generation of engineers!

An investigation into similar online resources that introduces STEM into the curriculum (i.e within geography, history, music etc) was taken in order to find out what teachers like about these resources and what could be improved. It was found that accessibility to equipment was a big issue for many activities; one activity found needed a vacuum chamber – not something you're likely to find in a primary school! Therefore, the project produced a range of activities that would allow more schools to be able to take part. A few of the activities from each session of the pack are described below.

Session 1 of the resource pack included a discussion about the water cycle and the importance of having clean water. Many countries in Africa often have difficulty accessing clean water which affects the whole community. Women and children are often forced to walk miles everyday to collect water for their family, meaning that they cannot work or go to school. The heavy containers of water can injure their backs and affect growth of children. Despite fetching water, it is often not clean and can be dangerous to their health. The practical activity for the first session was to make a water filter from a plastic bottle, sand, gravel and stones, as shown in figure 1. If you try this yourself, you will be amazed at how clean the water can look – just don't forget it isn't clean enough to drink!

Figure 1 – Water filter activity

The second session of the activity pack was based around dissolving and evaporation. We made a saturated solution of salt or sugar in water and left them in various places around the classroom and in different shaped containers, such as in tall thin cups or jam jar lids. The water evaporates out of the solution leaving behind an intricate pattern of crystals – try yourself and see if you can see a difference between salt and sugar crystals!

The final practical activity of the project was to build a water pump. This is a quick building activity that you can do with a few materials you will find online or in your home. Originally the design was quite complicated and needed lots of specialist tools and materials such as hand saws, drills, plastic tubing and wooden discs. With some experimentation, a new design was devised, which you can try yourself from the instructions below:

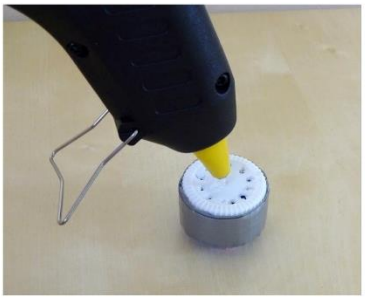
Instructions to make your water pump!

This is what it will look like! ->

You will need:

- 100ml Syringe (outer casing)
- 20ml Syringe (inner piston)
- 2x Water bottle tops
- 1p and 2p Coins
- Duct tape
- Glue gun
- Something sharp (like a compass or bradawl)

1.	Make a hole in one milk bottle top You may want to make the hole bigger using a stick or pencil!	 

2	In the other bottle top, make lots of smaller holes around the outside using something sharp	
3 4	In the bottle top with one hole, place the 1p coin. Duct tape the two bottle tops together with the holes on the outside.	 
5	Using a hot glue gun, attach the 20ml syringe inner piston to the middle of the bottle top with lots of holes.	 
6 7	Place the 2p coin inside the larger syringe Place the piston in the syringe.	 
	To work the pump, place it in a bowl of water with the water level reaching the top of the bottle tops (at the 25ml line here) Hold the pump with one hand and move the top of the piston up and down continuously.	

After completion of the resources, some other areas that would integrate STEM into the curriculum were 'mapped out' (i.e. planned) and can be seen in the mind-maps below.