**ABOUT THE AUTHOR**

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I've been having some conversations recently around how we could use technology to encourage innovation in STEM (Science, Technology, Engineering and Mathematics). Some of the discussions have been rich, rewarding and inspiring – while others have just gone over old ground and centered on putting kit into classrooms rather than actually thinking about what types of technology can support new ways of teaching and learning.

Putting children in front of laptops or tablets doesn't in itself encourage innovation. Recently I have been advising schools to think differently about how they spend their precious ICT budget; introducing a little more creativity when it comes to a hardware overhaul. This advice runs parallel to the advice that I always give schools about needing to make education fresh and exciting.

Let me explain... When I was at primary school I loved going in every day because there were things there that we didn't have at home. They had a big colour television (in the TV room!), A BBC Micro Computer (that each class had for a day every two weeks), a small swimming pool and our own nature reserve (with a bird hide). All of these things (and more), combined with good teaching and seeing my friends every day, made school for me an exciting place to be.

In contrast, I was speaking to a group of headteachers (over video conference) at the end of last term and I asked them what students found exciting about going to their schools. For some, it was a surprising difficult question and for others, although the answers came quickly, on reflection many of the things they listed weren't that exciting at all. In all cases the technology experiences that children were having at home were far richer, and more challenging and accessible, than those that existed inside the school gate.

Below I've listed a four pieces of hardware that have got real potential in STEM education. Some of them are already used in UK schools – but they are certainly not common, nor used consistently across the board. The technology isn't actually that expensive and could easily attract some one-off funding from a local authority, academy trust or a parent council. Also the next time you do a computer refresh consider swapping out a couple of laptops or desktops for some other hardware that isn't a Windows PC or a Mac. You can always make up your hardware shortfall by introducing ideas such as BYOD (bring your own device).

# MEET THE
# MAKERS

⊗ CHILDREN OF ALL AGES LOVE TO CREATE, SO WHY NOT NURTURE THEIR INCLINATIONS THROUGH TECHNOLOGY? OLLIE BRAY PICKS OUT SOME GREAT HARDWARE SOLUTIONS FOR STEM TEACHING...

# 1. LEGO (HTTP://EDUCATION. LEGO.COM/EN-GB)

Let's kick off with LEGO – quite simply there just isn't enough LEGO in schools and we need more of it to support the teaching of maths, science and technology. But let's not forget that Lego can also be incredibly useful for supporting the teaching of other subjects as well – such as creative writing and other components of literacy.

If you want to invest in LEGO there are lots of options available and the LEGO Education UK home page is a good place to start your search. The LEGO WeDo Construction Set is brilliant for early secondary and it enables students to build and program simple LEGO models that are plugged into a computer. The set contains more than 150 elements, including a motor, motion and tilt sensors, and the LEGO USB Hub.

Lego Mindstorms is perfect for all ages of secondary (including sixth form); it has been around for a while but their new EV3 models launch globally in August this year. The EV3 comes with a number of Design Engineering Projects within its curriculum package that lets your students work with open-ended problem-solving activities.

# 2. CUBELETS (WWW.MODRO BOTICS.COM/CUBELETS)

If you like the idea of making robots then you might also get enthusiastic about Cubelets (from Modular Robotics). In some ways they are quite similar to LEGO in that they link together to make shapes and structures. The big difference is that there are not as many parts and that each 'block' has a different function that when combined can do a sequence of activities / tasks.

The functions include motor, drive, temperature sensor, rotate, light sensor and lots more. You really need to see and play with them to understand the power of these little robots – but they certainly have a lot of potential in education!

# 3. MAKEY MAKEY (WWW.MAKEYMAKEY.COM)

The MaKey MaKey is an invention kit for the 21st century. It can be used to turn everyday objects into touchpads and combine them with the internet. It's a really simple invention kit for both beginners and experts interested in art, engineering and everything in between.

How does it work? Well, you alligator clip two objects to the MaKey MaKey board. For example, a person and an apple. Now, when you touch the apple, you make a connection, and MaKey MaKey sends the computer a keyboard message. The computer just thinks MaKey MaKey is a regular keyboard (or mouse). Therefore it works with all programs and webpages, because all programs and webpages take keyboard and mouse input. Confused? Check out the MaKey MaKey (www.makeymakey.com) website to find out how to update your Facebook profile using alphabet spaghetti, play an on-line piano with a bunch of bananas, and create a games controller out of picture you have drawn (clue: graphite in pencils conducts electricity).

# 4. 3D PRINTING (WWW.MAKERBOT.COM)

There is no doubt about it 3D printing is going to be big. According to Wikipedia, "3D printing is a process of making a three-dimensional solid object of virtually any shape from a digital model. 3D printing is achieved using an additive process, where successive layers of material are laid down in different shapes. 3D printing is considered distinct from traditional machining techniques, which mostly rely on the removal of material by methods such as cutting or drilling (subtractive processes)."

Over the last five years 3D printers have grown in popularity aided by their use in popular culture – for example, James Bond's Aston Martin DB5 that reappeared in the recent Skyfall Movie (http://goo.gl/U4WCF). As a result of their popularity the cost of a good 3D printer is now affordable for most schools and you can get a good one for under £1000.

There are lots of ways that 3D printing can be used in schools. The website TeachThought.com suggests ten possible uses as a stimulus to get you thinking:
1. Engineering design students can print out prototypes.
2. Architecture students can print out 3D models of designs.
3. History classes can print out historical artefacts for examination.
4. Graphic design students can print out 3D versions of their artwork.
5. Geography students can print out topography, demographic, or population maps.
6. Cooking students can create moulds for food products.
7. Automotive students can print out replacement parts or modified examples of existing parts for testing.
8. Chemistry students can print out 3D models of molecules.
9. Biology students can print out cells, viruses, organs, and other critical biological artefacts.
10. Math students can print out 'problems' to solve in their own learning spaces, from scale models to city infrastructural design challenges.

Of course, the actual application of 3D printing is potentially far more radical and far-reaching than the tasks and activities suggested above. 3D printing is already revolutionising the confectionery and cake industry because of 3D printing with chocolate (http://goo.gl/NJjbz). Edinburgh scientists have also used 3D printing (http://goo.gl/MeQrf) to produce stem cells in a technology that could completely revolutionise the medical industry over time.

The technologies above are not the only ones that could get learners building things and making school more exciting places to be. But they are examples of four technologies that will stretch your imagination of what exactly can be done in schools with the right investment and permission. If you're interested in this sort of innovation then you might also think about how you could make better use of games design in school (http://goo.gl/56IPNl) though uses of technology such as MIT's Scratch (http://scratch.mit.edu) and Microsoft Kodu (www.kodugamelab.com). Or why not invest in some equipment that encourages learners to build a camera (http://goo.gl/kywGia) or even a cell phone (http://goo.gl/30ViGu).?

The opportunities are endless... what we need now is imagination.