‘Robotics is ideal for connecting design technology with other subjects’

writes Dave Catlin

Dave Catlin, designer of Roamer and CEO of Valiant Technology as he continues his look at robotics in education. In the first article he demarcated educational technology (using technology as an educational aid) and technology education (learning about technology). In this article he focuses on technology education and the potential of robotics in Design Technology.

As a schoolboy I made a stool, a bookcase, lamp and a metal bowl. I remember walking through the streets and seeing kids from other schools lumbering home with their attempts at these same artefacts. Seemingly all over the country this was the prescribed outcome of woodwork and metalwork lessons.

In the early seventies Danum Grammar School in Doncaster broke ranks with this tradition and created a curriculum with a difference. They reflected the mood of many forward-thinking teachers who were realising that basic technical expertise no longer revolved around your ability to make a dovetail joint. Craft skills were not sufficient to guarantee the survival of Enterprise UK. Industry was heading towards the Information age. Innovation, creativity and design were the future. Gradually initiatives like the School Council's course in Control Technology and the Modular Technology Course influenced the emergence of the Design Technology National Curriculum [1].

Where are we going now? What technology do our students need to know? Is robotics one of them? For many years roboticists have made startling claims about what they think is possible. Is the age of the intelligent machine upon us? Well some people think so! A UK Government think tank predicted that within 50 years we would need to have a charter on robot rights [2]. This year the South Koreans started the process of drafting such a bill [3]. There are many, well informed people who claim we're no longer the smartest things on the planet. Whether this is true or not, what I see of robotic research convinces me that we need to embed robotics into our curriculum.

> “Time to debate what robotics should be D&T umbrella,” writes Dave Catlin.

Robotics embraces many of the topics we need to cover in Design Technology: mechanisms, structures, electricity, aesthetics, electronics and control. But its potential is far more than this: you cannot start to study robotics without bumping into issues involving philosophy, psychology, history, social science, politics, economics, art, science and maths. For example, lurking in the discussion of “robot rights” is the serious contention that robots will not just be intelligent, but conscious. How will this affect our children's future?

My point here is that robots have a huge potential to link technology with a wide range of contextual situations. Personally I think it's essential that we develop our students understanding of technology in relationship to the wider issues of society. Robotics is ideal for connecting Design Technology with other subjects in a way that makes both symbiotically more meaningful.

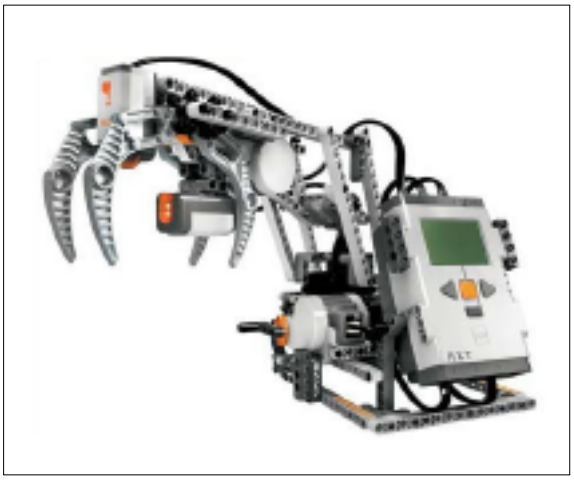
The relationship between man and "machine" was the central theme of Isaac Asimov's famous robotic stories. Asimov was a bone-fide scientist and one of the World's most famous science fiction writers. This reflects in his stories, which are a mixture of science and imagination. This combination pervades the history of the robots and it is one of the things that make robots such a potent educational tool. Robots trace their ancestry to the magical automata made by Ancient Greeks like Hero of Alexandria. Hero's creations exhibited artistic flair; yet their main purpose was to demonstrate the scientific principles of mechanics.

Robots are sort of automata with ICT added. This theme is epitomised in Lego: Mindstorms. In the process of manipulating the Lego parts and building the robot, students engage the principles of mechanics and structures, and their underpinning mathematical and scientific principles. They are doing this on a sort primordial level. Practically. Physically. I think this is so important. When you build and make a robot work, you understand forces by seeing and experiencing their effects. You gradually develop an intuitive understanding of science.

There has always been a tension between the theoretician and practitioner. Theory without practice is dandyish: practice without theory is brutish. Putting the two together creates the ideal.

While Lego is principally technology education, its contextual setting provides an element of educational technology. Roamer is the other way round. It is primarily educational technology, but it has the capacity for technology education. The Classic Roamer was designed as an amorphic blob so as to provide a sculptural base onto which students could create their own robot designs.

Sadly over the years Papert's original ideas [4] have faded and using robots like Roamer have tended to become a habit and not an opportunity to bring dull areas of the curriculum to life. The new robot, Roamer-Too, with its exciting new features such as speech, has been designed to revive and extend Papert's original ideas. "Disguise Kits" make it easier for Primary students to create robotic characters and provide the opportunity to use Design and Technology to enrich other curriculum areas like literacy, mathematics, science, etc.



Lego helps students acquire a practical understanding of basic engineering science.

Designing a robot character and giving it a personality has always been a fundamental idea behind Roamer.

For KS3 and 4 you can extend Roamers capability by adding one or more Control Pods, which increase the Input and Output capability of the robot. "Morphing Kits" serve the same purpose as the "Disguise Kits". Their style is suitable for older students and it facilitates the interface between the robot and systems like Lego, Inventa, Fischertecknik and Knex. You can detach the Control Pods from Roamer and run as them as standalone Control Boxes. Their ability to interact with the robot provides an Intelligent Environment™, which opens up a wide range of educational possibilities.

You can extend Roamer-Too's functionality by linking it to products like web cams and PDAs.

Essentially Roamer-Too provides a platform with various control options. Students can use the high-level Roamer programming language and the on-board Keypad Module, or they can take over the robot processor and write PIC Level programs. Unlike Lego's structured approach Roamer is open ended and flexible where students can use a wider variety of construction materials to give a different look and feel about the designs.

Competitions provide a popular inspiration for robotic activities and often encourage inter-departmental cooperation. They're great fun, but alas relatively few schools enter teams. Different competitions are starting to proliferate [5], but one of the more established and successful is "First Robotics" in the USA. This was the brainchild of successful entrepreneur Dean Kamen who set up the competition as a not-for-profit enterprise in 1989, to in his own words: "Create a world where science and technology are celebrated… where young people dream of becoming science and technology heroes".

Schools hook up with engineers from local industry to create a robot that will solve a problem (which changes every year). I worked with Rhodes High School in Cleveland Ohio on their entry circa 2002. Their engineering mentors came from NASA's Glen Research Center. The finals were in Florida. It was to say the least, wild and full of good old American razzmatazz. The energy levels of competitions are fantastic. The problem is that when students came back to school, there wasn't anything for them to channel that energy into (rectifying this was why I was involved with Rhodes). I think it is time we start to debate what a robotic curriculum should look like within the D&T umbrella.

[1] From information provided by Alan Paul, retired Senior Lecturer, Nottingham Trent University, School of Education.
[2] UK report says robots will have rights, (Financial Times) By Salamander Davoudi in London Published: December 19 2006 22:01| Last updated: December 19 2006 22:01 http://www.ft.com/cms/s/2/5ae9b434-8f8e-11db-9ba3-0000779e2340.html
[3] http://news.bbc.co.uk/1/hi/technology/6425927.stm Last updated: Wednesday, 7 March 2007, 13:46 GMT
[4] See previous article.
[5] See http://www.dcs.shef.ac.uk/~noel/competitions.html for links to several competitions around the world.