‘Valiant’s new Roamer-Too is set to Enhance the Effectiveness of Robots as a Teaching Tool’ writes Dave Catlin

With the launch of Roamer-Too, Dave Catlin claims that we can now incorporate real robotic power into effective teaching tools. In this article he concludes his series about the future potential of robots in schools.

Over the years I have seen many situations where children see Roamer for the first time. Typically, they look in fascination and talk about it with an air of furtive excitement. One or two, with a wary eye on nearby adults, tentatively start prodding keys. They never discover the correct syntax, but happily sit there, pressing keys and producing negative burping sounds. Usually the nearby adult monitors the episode, patiently waiting for the appropriate time to step in and tell them how to program the robot.

Now imagine a new type of robot: a robot with intelligence. When the student, enquiringly presses a key (any key) the robot responds: “Hello I'm Rosie Roamer” (children make up the name). This is the start of an interactive process where students explore and discover what the robot does and how they can make it do those things. Instead of burping, the robot talks to them. It responds to each press with hints and questions, eventually guiding the student to programming mastery.

This scenario illustrates Intelligence and Interaction, two of the ten ERA (Educational Robot Applications) principles used by Catlin and Blamires [1] to evaluate the educational value of robots.

In the first of these articles I recalled Seymour Papert's original insight in combining the principles of Artificial Intelligence and learning. This resulted in the development of the Logo programming language. When students program in Logo they exercise natural thinking and problem solving skills (the ERA Sustainable Learning Principle). In the Big Brain Academy for the Nintendo DS we see a variation of Papert's idea: namely we can use technology to exercise the brain. By engaging in mental activities we make ourselves smarter, a bit like physical exercise makes us fitter.

Compared with Logo the Big Brain Academy engages different thinking skills. Roamer-Too recognises there are many possible “brain exercises”, each toning some aspect of our mental life. The thing about Roamer workouts is they do not just fine tune mental dexterity with an abstract exercise. Instead they get students exploring and grappling with ideas of maths, science and language. In this aspect Roamer still follows Papert's constructivist approach, but adds the ERA Principle of Curriculum Relevance (an educational robot's value is its ability to facilitate learning curriculum content through good teaching practice).

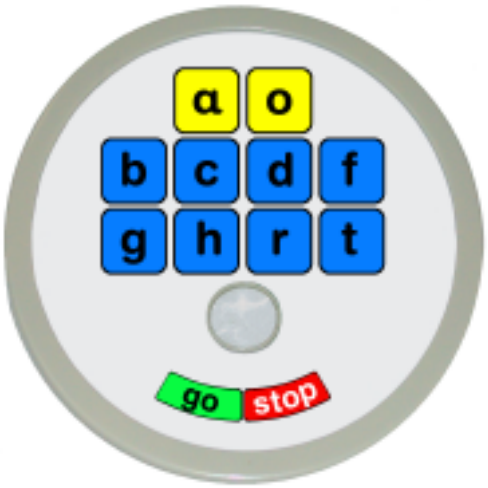
The Intelligence Principle simply states that for a robot to have value it has to have an intelligence that allows students to engage in useful educational activity. Deep Blue had enough smarts to beat world champion Gary Kasparov at chess, but couldn't beat anyone at draughts. Its intelligence was focussed on a particular task. The new Roamer is not stuck with a single Behaviour; you can change it to suit the need.

Valiant's Kate Hudson explains: *"iPod is an example of a technology that you can set up to suit your personal tastes. Roamer-Too has the same capability. You can download different Behaviours in a couple of minutes to create new and exciting situations for the children to explore".*

The Incy Wincy Spider Activity is an example of Storytime Roamer. The new robot is given a Behaviour that supports the development of skills essential in early readers. On the cognitive level the task develops the child's syntagmatic memory through narrative. In education parlance we are trying to get children to comprehend the story in terms of events and the sequence of those events. The keypad for this activity consists of images that represent the events in the rhyme. When the student "programs" the right sequence Roamer recites the rhyme and enacts the story. If they get it wrong the rhyme is jumbled up.

Roamer-Too develops the tradition of the children creating the character of the robot. This is made easier to do with a range of "dressing up kits" and "morphing packs" that transform the appearance of the robot getting it in character for activities like Incy Wincy Spider.

Roamer still has Behaviours based on Classic Logo type programming. The ability to change the Behaviour and Keypad Graphic means we can scaffold the process of learning how to program the robot. It starts with the Early Years Roamer and the Counting Paradigm invented by Duncan Loutitt, and gradually introduces more familiar commands like Forward 3, Repeats and Procedures.



Roamer's keypad is like a Concept Keyboard: you can change the graphic to suit the Behaviour and the Activity. This keypad is one of a series dealing with early literacy skills. In this case the robot asks children to spell cvc words, like dog, cat, etc. The robot provides visual, auditory and kinaesthetic responses to their endeavours - either helping them when they make mistakes or celebrating their success.

However, we should not get fixated on the idea of Keypads and programming sequences. The ERA Principle of Interaction implies more than this. It identifies students as active learners whose multimodal interactions with educational robots takes place via a variety of appropriate semiotic systems. The word "semiotic" essentially is about how we communicate. Interaction is about how the student and robot communicate knowledge and understanding. Modern robot technology is nearing the stage where we can have more natural interactions. For example we can talk to it, move our hand in a meaningful gesture and create an environment that causes the robot to react according to its personality.

Roamer-Too (shown here with one of its ready-made Disguise Kits) introduces a new feature to this type of robot: the ability to change speed. You can program it to travel at speeds from 5 cm to 50 cm every second. This feature makes possible activities like Fastest Route: a problem solving challenge suitable for Year 6 pupils. Students experiment with the speed of the robot over different terrains shown on a map. Their task is to calculate, then program the robot to find the quickest way between two locations. Roamer (which has a mental map of the terrain) automatically goes faster or slower when it is in different locations.

Cynthia Breazeal's Kismet [2] robot responds to social interactions with people. Such technologies are currently expensive and restricted to the experimental laboratories. Time will sooner or later make them accessible and affordable. Roamer-Too is a platform designed to interface with existing technologies (for example the PDA example portrayed in the last issue) or future technologies like Kismet's.

Technology is not the crucial issue: the crux is how to use robotic ideas effectively in education. The ERA Principles aim to provide a frame-work for understanding this and guidance for the development of effective activities [3].

The new Roamer sells for £79.95 and consists of a Base Platform and Keypad Module with a choice of a Standard Behaviour chosen from Early Years, Infant, Primary or Junior Roamers (you can buy all the Standard Behaviours for a further £14.95).

Roamer-Too is powered by standard AA Cells and a rechargeable version is available. The new robot moves with the high accuracy reminiscent of the Valiant Turtle. There are plans to interface the robot to popular Logo Software, which will revive all the excellent Turtle Graphics activities popular years ago. The robot has an in-built programmable output, which you can use to lift and lower a Pen Module (£14.95) - completing the robot's return to its original Turtle roots.

The latest version of RoamerWorld Software has a key role to play. Like the original RoamerWorld you can write, save and edit Roamer programs on the computer. The new software has many exciting modules that extend the capability of the robot. One of the most exciting is the Speech Centre Module. Here students write dialogue and add sound effects that they can download and use in the robot adding interesting dimensions to creative writing opportunities.

The Practicality Principle acknowledges that busy teachers want "out of the box ready activities". Valiant has commissioned groups of experienced teachers to create a core of 35 Activities for each year in the age range Years 1 to 6. They are also working on packs for pre-school and KS3 and 4.

However, Kate Hudson is aware of the huge potential of the product and the need to meet the Personalisation Principle: *"We recognise teachers want to make activities relevant to the specific student, but teacher's preparation time is always a problem. That's why we are encouraging the development of open source activities, which teachers can rapidly modify to meet their needs. We are very happy to support teachers, researchers and student teachers with activity ideas. So we have launched the RoAD (Roamer Activity Development) Partnership to help support their creation".*

There is a lot of work and research to be done, but Roamer-Too paves the way for intelligent robots to support busy teachers in providing exciting and effective learning.

[1] Catlin, Dave and Blamires, Mike: 2007 In Press.
[2] http://www.ai.mit.edu/projects/humanoid-robotics-group/kismet
[3] The ten ERA Principles are: Intelligence, Interaction, Embodiment, Curriculum Relevance, Pedagogical Method, Sustainable Learning, Personalisation, Equity, Engagement and Practicality.