



For most of us, computer science means robots and soldering irons, or pimply youths programming arcane code. **Sarah Jones** busts the myths to find out where computer science fits in the curriculum



# Controlling the machines

**P**rofessor Tim Bell from the University of Canterbury believes more New Zealanders should be developing new computer technologies to sell around the world. The problem is that learning how to build new technologies has been missing from teaching and learning programmes in many of our schools.

## Debate about the curriculum

A group of vocal teachers and industry spokespeople claim that computer science has fallen into neglect. They point to a skills shortage in the IT industry and falling enrolments in university courses as evidence we need to give it more priority in our classrooms.

The problem, says Tim, is how you define computer science. "We're currently addressing how to use computers and how to deliver education using computers: movie making, video chat with experts, distance learning and so on. What we're not addressing is learning how to build new systems and technologies."

The Ministry of Education is rolling out updated achievement standards for years 11-13 which will help remedy the situation, but Tim acknowledges

that the availability of professional development is still an issue for teachers.

## Programming for beginners

What is required at intermediate and primary levels? Is computer science even relevant given the focus on literacy and numeracy?

"My concern is that, if we're not teaching computer science, we're missing an opportunity for students to think creatively, communicate clearly and design real systems that provide real feedback," says Dave Winter. He's taught programming to students at Kaharoa School in Rotorua and Southwell School in Hamilton.

"With computer science, you've got the opportunity to manipulate, control and create technology. This requires risk taking, problem solving and other dispositions that are front and centre of the curriculum," he says.

Tim also focuses on the big-picture benefits. "Computer science is as much about programming as astronomy is about telescopes. It's really about building a product that is fast, secure, scalable and usable - something that delights those who use it." ▶

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## 21st century challenges

MIT's Mitchel Resnick thinks fluency with technologies is about more than texting, playing online games and browsing the web. He co-authored Scratch, a free tool for children aged eight and up to create their own interactive stories, games, animations, music and art.

He wants children to go beyond playing with media designed by other people to develop a relationship with technology where they have some of the control.

In an article published a couple of years after Scratch's launch, he says "digital fluency requires not just the ability to chat, browse, and interact but also the ability to design, create and invent with new media".

Dave adds that the argument for computer science is about more than fixing the current skills shortage. "The challenges we will face in the future include developing carbon sequestration, clean water and other things we haven't even dreamt of yet. We need more citizens capable of sophisticated systems thinking and problem solving, rather than saying these things are specialist tasks left to a few."

## Cheap and cheerful

Scratch exposes learners to the thinking, constructs and ideas required for programming without the obscure punctuation or syntax traditionally associated with it.

You use Scratch by "snapping" together graphical blocks of instructions to control objects that perform actions such as dancing, singing, running and talking. Its visual approach encourages a kind of programming messy play: tinkering, experimentation and incremental design.

A colleague of Dave's is using Scratch in units about belonging and culture because it offers more creative, non-linear ways to tell stories. A version of Scratch for preschool and junior school children is due out later this year.

Computer Science Unplugged is another resource for the very young. It's a collection of free activities that teach computer science through games and puzzles that use cards, string, crayons and lots of running around. That's right - no computers. The website and book was co-authored by Tim Bell, who discovered a total absence of resources at primary level when his first child started school.

## Robotics

For the middle school, and at the other end of the spectrum in terms of cost, there's LEGO Mindstorms.

One of Dave's students is making a robot that turns manuscript pages on a stand for a musician. For a sustainability module, year 7 girls are building a miniature bedroom with a light that only switches on if it is dark and someone enters the room.

Dave acknowledges that girls are typically involved in smaller numbers than boys. They are interested in different problems and different ways of working. In an effort to control boy racers, his students have built cars that alter their speed in response to changes in the environment. They've also architected designs in another free tool, Google SketchUp.

More important than the tool, though, is for students to "get inside the cycle of learning, creating and sharing, and then bring in more learning from the sharing process", he says.

## Pushing ahead

It might be hard to imagine computer science becoming common in junior classrooms, but computer science fits any teaching and learning programme that values 21st century competencies and skills. Dave believes the students will push it forward, especially as more schools allow learners to bring their own devices to class. It's inevitable, he argues, because "it's a way for students to express themselves and get their ideas out there".

He has high expectations of what learners can achieve. "Students love doing things that are sophisticated. It's within the reach of more students than we think. Computer science is about creating things for yourself and your community, and that's powerful learning." ■

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## Resources

Computer Science Unplugged: <http://csunplugged.org/>

Douglas Rushkoff: <http://www.rushkoff.com/program-or-be-programmed/>

Google SketchUp: <http://sitescontent.google.com/google-sketchup-for-educators/Home>

LEGO Mindstorms: <http://education.lego.com/en-us/preschool-and-school/upper-primary/8plus-mindstorms-education/>

Raspberry Pi: <http://www.raspberrypi.org/>

Robocup: <http://robocupjunior.org.nz/>

Scratch: <http://scratch.mit.edu/>