Technology and inclusive learning: an interview with Dr Kirsten Ellis, Senior Lecturer at the Department of Human Centred Computing

Dr Kirsten Ellis has a creative and technical background and has experience in designing, developing and evaluating systems for people with unique requirements. A Senior Lecturer at the Department of Human Centred Computing (Monash University, Australia), her research interests include human–computer interaction and how technology can create a more inclusive society. She has developed multiple resources using a variety of technologies, including on the Nintendo DS lite, iPad, iPhone, Android and Microsoft's Kinect. She is also involved with creating a variety of activities to engage everyone in STEM Making, no matter what their abilities are, ensuring it possible for everyone to get involved in the making process. *The Biochemist* spoke to Kirsten about her work and the importance of inclusive learning.

Can you tell our readers a bit more about the activity TapeBlocks, which you developed for children engaging with STEM (science, technology, engineering and mathematics)?

I wanted to develop a circuit-making activity that anyone could do, even if they have a physical or cognitive disability. TapeBlocks are children's EVA foam blocks that are wrapped in conductive tape, with electrical components placed under and over the tape. By pushing the blocks together, a circuit is formed. It's so easy you can even push the blocks together with the back of your hand. If you can use tape, then you can make blocks, which are a much lower entry level for making circuits as there is no breadboarding or soldering required – not even any clips. It's possible to make a whole variety of TapeBlocks, including lights, vibration blocks (so blind people can feel when they have made the circuit correctly), buzzers (so children can annoy people), fans and lasers (just because they are fun). It's also possible to use buttons, tilt switches and light sensors, which are all taped to the blocks. TapeBlocks can also be used as the basis for making characters or cars, so that the circuit becomes meaningful to the maker.

TapeBlocks really challenge how circuits are made and, therefore, who is able to make them. This creates the bigger question: what else can people with disabilities do if activities are designed to meet their needs?

What other technologies have you developed to be more inclusive?

I created an upside down braille keyboard. When people learn braille, they learn it in a straight line, but that makes no sense because braille is six dots arranged as two rows of three dots in a rectangle. So, I created a keyboard that has the dots arranged in a rectangle. The innovative thing is that if you turn the keyboard upside down, then the correct fingering is learned, which has been one of the limitations preventing this method previously. This is most useful for the parents and teachers of blind children to learn braille. If they are confident with braille, then they will have the skills to support blind children with braille, which is really important.

You've developed a lot of technology that teaches sign language – how does this work?

I was working on designing and developing sign language teaching systems. Ninety percent of deaf children are born to hearing parents; so if they want to communicate with their children, they may choose to learn sign language. I have developed computer programs, Nintendo DS, iPad and Kinect systems, to assist people to learn sign language. As new technologies are developed, they provide new opportunities to improve sign language teaching. Computer programs made it possible to have much more control over the learning process as learners could repeat signs or watch videos with different viewing angles. The Nintendo DS was the first attempt to develop a portable sign language learning system that was designed to be more fun to engage with, as it was based on a labyrinth style game. The iPad provided a larger platform in a portable system to learn sign language and more people in the community had access to the system. The Kinect provided the ability to track peoples' movement and provide feedback on whether they were getting the signs correct, which is important during the learning process.

Why do you think it is so important for science and STEM engagement activities to be inclusive?

It is really important to have a diverse range of people in STEM because every person can provide a different way of looking at problems. If we only look at a problem from one direction, then we will never find the best solution. People who live with a disability have the most knowledge about the problems associated, which is the first stage of solving any associated issue. I also see it as a human rights issue. Everyone should be given the opportunity to engage with science and STEM engagement at a level that is meaningful for them.

TapeBlocks were originally made for adults with disabilities, but because of their design, they are great for children, they can be used as an enrichment activity in aged care and they can be used to change peoples' perception of how difficult circuit making is. When we design activities to be inclusive for people who have a disability, they become accessible for far more people.

Where can you see your research going in the next few years?

I think I will continue to solve real-world problems for people with disabilities as and where I see them. Currently, there is a lot of pessimism over technology replacing people with disabilities in the jobs that they do, but I wonder how we can use technology to support people with disabilities to have better jobs, so they can work together.

Do you have any future projects you can share with us that you're particularly excited about?

I've been trying to create some making activities that are accessible for people with all sorts of abilities. I'm still working on the easiest way to make a light up box, so that it is easy to put together. I have made about eight prototypes so far, but I think there is still room to make it physically easier to construct, with a more coherent order.

What has been the greatest challenge in your career so far – how did you overcome it?

I think the biggest issue I've faced is having my field of research recognized as legitimate. When I started researching technology for teaching sign language, there were about three people worldwide working in the field. There are a few more now, so I have moved into making for people with disabilities. There are still only a couple of papers in the field though, which means it's difficult to publish as there are no reviewers with the required expertise to assess the work. Just because a research topic is not popular does not make it unimportant. This type of research has a real impact, but does not fit neatly in academia.

What do you like to do in your spare time?

I do lots of arts and crafts: resin pictures, costumes, puppets; I'm always making things. I sing and play the piano, and I have a horse called Alby, so I ride a few times a week. I also downhill ski, rock climb, sail and fly planes, depending on the season. ■