How might we use technology to help humanity?

Year 7 digital technologies class at Ivanhoe Grammar in Melbourne is working with e-NABLE to building prosthetic hands – ***Steve Brophy***

"Never doubt that a small group of thoughtful, committed citizens can change the world. Indeed it is the only thing that ever has."
Margaret Mead

Great design is human centred. Built to solve problems and meet need. With the rise of additive manufacturing or 3D printing as an accessible avenue for people to create their own designs and products, the potential to solve more problems grows exponentially. 3D printing is still working towards being mainstream but has seen a large increase in use within schools. Sites like *Thingiverse* allow anyone to download and upload 3D files and there is a plethora of great and not so great items for people to print. The challenge for schools is how to move past a culture of printing knick-knacks or novelty items to a culture where students build prototypes and solutions that solve real problems for people.

The key is empathy

In our Year 7 Digital Technologies subject, our big question is "How might we use 3D printing to help humanity?" We immerse ourselves in how this technology is being used in the real world, discussing ethics, values and the power of such technology to make good and bad decisions. To raise the bar of student expectation in terms of design and social impact, we are working with the e-NABLE Foundation *www.enablingthefuture.org* to develop 3D printed prosthetics.

e-NABLE is a community of designers, engineers, teachers, students, parents who volunteer to design and build 3D prosthetic hands for those born with lower limb deficiencies. e-NABLE began in 2011 when South African carpenter Richard Van As saw a *Youtube* clip from prop designer Ivan Owen. Having recently just lost four fingers in a woodshop accident, Van As was immediately drawn to the design as a possibility to give him back use of his hands.

The prop, inspired by an early 1800s hand that Australian dentist Robert Norman, was designed using whalebone, cables and pullies. News spread around South Africa and a mother of a child (Liam) born with a lower left hand asked if a hand could be designed for her son. The first hands were made of metals and plastics and were quite cumbersome to assemble.

As many parents can attest to, kids grow quickly and so Liam quickly outgrew his first prosthetic. This was a real challenge and it wasn't until Makerbot, a maker of 3D printers got involved that the first 3D designs were created. As the saying the goes, the rest is history.

The e-NABLE community has grown thanks to the human desire to help each other out. The open-source nature of the community paired with ongoing feedback from prosthetic recipients has seen the hand designs continually evolve and improve.

There are now a huge range of hands available online through the e-NABLE website and Thingiverse. With names like the Raptor and the Phoenix, they sound as cool as they look.

The Phoenix hand is the hand that our students were tasked with to create. This model was chosen because 95% of the components are 3D printed. With the combination of some fishing wire, screws and tools such as pliers and wire snips, students are able to fully assemble a functioning hand. The process of downloading the files and uploading to the printer introduces students to the language of 3D printing; STL, resolution, raft, supports, thermoplastics and so on. The first print students create is a group task where the goals of the project are to introduce students to the mechanics of the hand, troubleshooting techniques and most importantly, how to organise your workload to ensure your hand can be completed successfully. As there are many small parts and each item is for a specific part of the hand, being able to work methodically is a vital skillset. Each group must document the process via photos, video or notes and collate these in OneNote.

The next task for students is to learn how to fit a hand for a recipient. The recipients in this case are themselves. This involves learning how to measure to fit, how to work out the scale and how to scale each part using Tinkercad. Fitting a hand for themselves also allows students to feel what it would be like to wear a prosthetic. This is a really important process as it allows students to adjust the design elements with a human in mind, i.e. themselves. Adjusting the design for comfort, for functionality, and practicality by truly understanding how it feels to use a prosthetic is a key part of providing students with a new perspective. Truly knowing what it feels like to be without a lower limb is not possible but taking the time to try is the key part. The end goal is to work with e-NABLE to provide those born with lower limb deficiencies with fitted prosthetics. Along the way students raise their expectations for technology and see the power in using such a medium to help others.

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