

## CREATIVE DEVICES Makers Empire

## **JOEL AARONS**

his year, I have started at a new school, in a slightly different role. I am still teaching a condensed version of my previous Media Arts program, but, for the most part, I am now labelled a STEM teacher. My job was to take over the school's very successful STEM program that it had been running for the past few years and expand on it. When I started, one of the first things the principal told me to do was to evaluate the school's ageing 3D printer. I couldn't even tell you the brand of the thing, but it was mostly in pieces and obviously on its last legs – so it was up to me to look at purchasing a new 3D solution.

This was exciting to me; I had heard a lot of good things about Makers Empire,<sup>1</sup> and saw this as an opportunity to bring the company's software into our school. Makers Empire is an Adelaidebased company that provides software aimed at the Foundation – Year 8 student market, with a dedicated curriculum to go with it. The company was started in 2014 with the intention of developing an app solution for students to model 3D creations, in a simpleenough way that would allow them to spend more time on creativity and less time on stressing about the technicalities of the app. As Mandi Dimitriadis – a former classroom teacher and curriculum developer for the South Australian Department for Education who now serves as Makers Empire's director of learning – tells me, the company's 3D learning program 'is aligned to design and technology curricula around the world', and functions as a 'tool for developing general capabilities such as ICT [information and communications technology] competencies, critical and creative thinking, literacy, and numeracy'.

In my past role as a pure Media Arts teacher, I had done a little 3D design with my students using a variety of apps. In Adobe Illustrator Draw,<sup>2</sup> the younger kids designed a pendant, which I then went and extruded into a 3D object myself. On another occasion, I got students to build houses on *Minecraft*,<sup>3</sup> which could then – after much trial and error – be exported as 3D STL files to be sent to the printer. Elsewhere, I got students to mould a virtual ball of clay into a 3D creation through a Windows app called Sculptris.<sup>4</sup> Finally – and probably most successfully – I introduced students to another Windows app, 3D Builder,<sup>5</sup> which allowed them to combine shapes into 3D models. What I concluded, however, was that, if design thinking was to be a serious unit, students would need to be taught constructively, and their designs would need to have meaning both to their learning and to their world.

In her role, Dimitriadis provides professional development for educators – even at a trial stage, where she explores not only what the software can do, but also how it links up to the curriculum and the emerging STEM culture in schools. She tells me that she sees significant benefits in 'engaging students in authentic design-thinking contexts', and that 3D printers can be 'extremely useful tools' for bolstering that learning:

3D printers support the iterative nature of design thinking by enabling students to rapidly prototype ideas, test their prototypes, and make improvements and tweaks to their models. Desktop 3D printers are relatively portable and affordable, meaning that students can have easy access to tools to produce prototypes and products.

She also notes that they represent a major technological upgrade on the design methods that schools have traditionally had access to:

In the past, particularly in primary school classrooms, it has been difficult for students to make 'real' products, and design projects often result in cardboard models of representations of solutions. With 3D printing, even our youngest students can create authentic, useful products.

What I really liked about Makers Empire was that it provided a comprehensive package, and one that can make sense to students from five to fifteen years of age. As a result of my previous classroom 3D-design experiences, I recommended to the boss that we get not one but two printers – with all students needing to have something printed at some point, one just wasn't going to cut it. Makers Empire had exactly what I was after: we were able to purchase a school subscription that also provided two classroom-appropriate 3D printers (the company also offers printer-only or subscription-only packages<sup>6</sup>).

The real beauty of Makers Empire doesn't lie in the printers or the software. In my opinion, where the company really shines – and the reason I was so eager to go through it – is in the wealth of curriculum-based lessons it provides, along with a host of lesson plans and a thriving community that contributes to the lesson bank. On top of this, the Makers Empire subscription allows teachers to set up classes and assess designs as they come in. Students have their own accounts (in our case, linked to their Google for Education accounts that we already set up), which are linked to their teacher's. According to the company's website, there are currently over 16,000 educators and 850,000 students in its community across forty countries.<sup>7</sup>

For Dimitriadis, this is part of a growing shift in the way 3D design is being integrated into educational settings: '3D design and printing are no longer being viewed as the sole domain of technology teachers and tech-savvy students [...] young children are starting formal schooling with access to 3D-modelling tools as a natural part of their experience.' She sees this as a trend that will continue:

I believe that 3D-modelling software and 3D printers will increasingly become part of the furniture in everyday classrooms. My vision is that the 3D printer becomes just another tool in students' and teachers' repertoires for creating products, adding specific elements to learning projects and producing prototypes to test and refine ideas. I think that the desktopstyle printer will continue to drop in price and become more efficient and accessible, just like paper printers have done. I think desktop printers will continue to be used in schools for producing cost-effective and time-efficient prototypes but schools will increasingly outsource 3D printing of final projects in high-quality products such as metals, as these services are also becoming increasingly accessible.



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FIGURE 4

FIGURE 5

Tutorial

The Makers Empire software - Makers Empire 3D - is available as a Windows, Mac, iOS or Android app. Once students log in, they are immediately asked to create their own avatar by using the tools within the app. To start with, the app points to what they have to do to create something simple. The app provides character 'parts' that students can choose from and customise (Figure 1).

Once done with that, they are brought out into the Makers Empire world (Figure 2). From here, they can run through a tutorial course to get started, access challenges and competitions, or play games created using the 3D software. There are links at the top that they can click to start a design from scratch, view a gallery of student work or go through their own designs. One element I really like about the gallery is that it can be filtered so that students see peers from their cohort, or school, only (Figure 3). There is the opportunity to 'like' designs, as well as to provide comments (Figure 4).

There is a gamification aspect to the community, too. The more you design yourself, or give feedback on other designs, the more you can earn tokens and 'level up' in achievements. With those tokens, you can 'buy' locked shapes that can be added to future designs. You can also sell your designs by putting a token price on them. If someone likes something you made enough that they want to use it themselves, they can purchase it, and the tokens go into your account.

The 3D-creation tool, accessed by hitting the CREATE link, currently gives you six different modules you can work from (Figure 5): 'Shaper', 'Blocker', 'Character', 'Toy Designer', 'Cogger' and 'Doodler'. Students, when given time on their own to create, may choose a variety of these tools, but in my classes I mostly use Shaper and Blocker, which I will talk about in more depth here.

In the Shaper module, you are given a library of two- and threedimensional shapes that you can build a model out of. Through the tutorials, with help from the teacher, students can learn how to add shapes and manipulate them by adjusting scale, rotation and skew. They can change the colour of shapes, as well as link them together, subtract shapes from other shapes, duplicate them or invert them. They can also use the 'text' tool to create 3D text, and the 'drawing' tool to free-draw a shape.

FIGURE 6

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In the example pictured in Figure 6, I created a yellow rectangular prism, possibly as the outside of a house. I then duplicated that prism, changed its colour to red (mainly so I could differentiate between them), resized it down slightly (using the 'fixed-resize' option, which ensures that all dimensions are resized proportionally) and then switched to 'free resize' and extended the second prism upwards. I did this so I could use the red shape to cut through the yellow shape (Figure 7). Through an exercise like this, you can see how it is possible to cut shapes with other shapes. This could be the start of an empty house, which students could then cut doors and windows out of and start furnishing.

With the Blocker module, students design in a different way. This tool is ideal for students who want to build block by block (or a row of blocks at a time). One of the lessons that Makers Empire provides, and that my Year 6 students did, was making mazes. After watching the supplied introductory video for the lesson, my students sketched and designed their own mazes. They started by drawing a block and then cutting paths through. Finally, they added a bottom plate to the maze so that it would all hold together. Students who had the time also designed little gates on either end of the maze (Figure 8).

So far, I have done three main projects with my students. After the Year 6 students had started with the maze activity, I wanted to give them something more 'real-world' to tackle. I gave them the option to design either a mobile phone holder for a car or a receptacle for a teacher to put their whiteboard markers in. Once they had finished sketching, students had to do a lot of measuring to work out how big the model and each of its components needed



FIGURE 7

FIGURE 8



FIGURE 9

FIGURE 10

FIGURE 11

to be. Design is important, I reminded the students, but it needs to be functional as well: it doesn't matter how good it looks – if it doesn't do what it's meant to do, then you've missed the point. As a first go, many of the students failed to make something that was the right size; however, that is all part of the learning process. If we had more time (and a lot more filament), I would have allowed them to revise and reprint. As it was, the students each only had the one model printed (Figures 9 and 10).

I also used Makers Empire with my Year 2s. After going through the tutorial stream, I gave the students a session or two to make what they wanted and explore the tools. I then had them design and create bubble wands (another lesson provided through Makers Empire's teachers' dashboard). By adding, combining and manipulating shapes in the Shaper module, students successfully made a range of different-looking wands (Figure 11).

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It is my intention for all students in our school (from Foundation to Year 6) to get the opportunity to use Makers Empire 3D. There are plenty of lessons for all year levels in the library to choose from, as well as ones provided by the community.

The software is not perfect. Personally, I would like to see there be more scope for students to accurately manipulate shapes. Right now, there is a ruler setting, which students can use to resize objects by entering in exact measurements; I would like there to be a way to enter in specific angles and specify exact coordinates. Currently, there doesn't seem to be an option for the model to sit flush on the base (and thus on the printer plate), which is something I would also like to see.

Additionally, Makers Empire 3D is not cheap. However, a lot of time and effort has gone into its creation, and I believe the price

is well worth it. Not only is it a student-friendly piece of software, but it also contains a wealth of teaching and assessing tools for educators. When the year is up, we will need to make a decision as to whether to continue our subscription, but my principal has already seen what joy, creativity, inspiration and hard work have come out of these lessons, and I'm sure we will continue our Makers Empire journey for a long while.

Joel Aarons is the Media Arts and STEM specialist teacher at Camberwell South Primary School in Victoria. He is also an Adobe Education Leader and a Microsoft Education Expert. Joel has a blog at <http://media artsconfessions.wordpress.com>, where many of the lessons here are gone into in more detail, and has published an interactive ebook that contains video tutorials and downloadable resources for all his lessons. He has also presented and spoken at many conferences, and can be reached on Twitter @mrjoelaarons. **SE** 

## Endnotes

- <sup>1</sup> See <https://www.makersempire.com>, accessed 17 July 2019.
- <sup>2</sup> See <https://apps.apple.com/au/app/adobe-illustrator-draw/ id911156590>, accessed 17 July 2019.
- <sup>3</sup> See <https://education.minecraft.net/>, accessed 17 July 2019.
- <sup>4</sup> See <https://pixologic.com/sculptris/>, accessed 17 July 2019.
- <sup>5</sup> See <https://www.microsoft.com/en-au/p/3d-builder/ 9wzdncrfj3t6>, accessed 17 July 2019.
- <sup>6</sup> Makers Empire's printer-only bundles start from A\$1499 + GST, and its subscription-only bundle costs A\$1999 + GST per annum, whereas the complete bundles start from A\$2999 + GST per annum. See <a href="https://www.makersempire.com/compare-and-buy/">https://www.makersempire.com/compare-and-buy/</a>, accessed 17 July 2019.
- <sup>7</sup> 'About Makers Empire', Makers Empire website, <a href="https://www.makersempire.com/makers-empire/">https://www.makersempire.com/makers-empire/</a>, accessed 12 July 2019.