

3D Printing in an Elementary School Setting

By Carl Bull, Vice-Principal, L.A. Desmarais

Imagine a geometry assignment that you literally have to pull students away from, one that targets multiple curriculum objectives as well as connects them to a myriad of well-paying career opportunities. I have been involved in one such activity, the increasingly ubiquitous technology of **3D printing**. This process has been employed by a diverse array of North American companies utilizing it to produce houses, cakes, artificial limbs, car parts and a multitude of other objects.

Interestingly, this process is leading a resurgence of the manufacturing industry in North America, particularly for small businesses due to its affordability, reliance on creativity and scalability. This quality, and many others, makes it a perfect STEM-based activity to engage our pupils.

The Why

The *Why* begins with curriculum. I have provided a few excerpts from the Ontario Math Curriculum, but could have quoted dozens of other objectives and many more ministry documents. The evidence and motivation are clear: students must put into practice and connect in a meaningful way to the material we want them to learn.

“Selecting Tools and Computational Strategies: Students need to develop the ability to select the appropriate electronic tools, manipulatives, and computational strategies to perform particular mathematical tasks, to investigate mathematical ideas, and to solve problems.”

“Connecting Experiences that allow students to make connections – to see, for example, how concepts and skills from one strand of mathematics are related to those from another – will help them to grasp general mathematical principles.”

“Grade 8: Geometry and Spatial Sense Overall Expectations ... represent transformations using the Cartesian coordinate plane and make connections between transformations and the real world.”

Another *Why* comes in the guise of the decision structure that students typically face with the launch of high school. Course decisions come fast and furious and are domino in nature. We need to expose our elementary students, especially the girls, to advanced technology that might spark their interest in STEM-based careers.

The How

A variety of free online 3D modelling programs exist, I have been using Tinkercad for this purpose and have been very happy with it: excellent support, an easy to navigate visually-driven interface and widespread online communities. I learned the ‘ins and outs’ of the application through YouTube videos and trial and error (although the students somehow always pick it up faster than we do). I typically do short class demonstrations followed by assignments reinforcing the skills discussed.

After a few lessons, students are turned loose on a project that has a high degree of individualization. A few examples:

one grade 6 class created artifacts from biblical times to bring to life a religion unit; a grade 7 math class created individualized boxes with fitted lids. However, my all-time favourite was all 68 of our grade 8 students generating a scaled model of their favourite room (part of the project was providing accompanying pictures from their homes and actual room and furniture measurements).



The Who

It is always the challenge for school leaders to find the right person for the right position, but this is compelling stuff. You might be surprised who steps forward!

Special Education

I believe that whole class participation is a key facet of the success of any lesson. Fortunately, I have found it easy to scale difficulty level and thus effectively differentiate tasks for all pupils.

The Cost

For school use, 3D printers typically range in cost from approximately \$600 (ex. Creality CR-20) to \$4,000 (ex. Makerbot Replicator+). Predictably, less expensive instruments require more set up time and separate slicing software than their more expensive counterparts. PLA filament, predominantly used in school settings due to its benign nature, represents an ongoing cost much like science and tech labs require consumables. I have found this component very manageable and relatively easy to absorb at about \$50 per kg, which will provide material for dozens of small student projects.

Other costs might be incurred depending on the requirements of your facilities services/board. It is always prudent to check in prior to implementing any new technology.

I have been fortunate to find sponsors and/or fundraising for these devices. Honestly it is easy to generate excitement within communities regarding the purchase of this technology, which is so clearly relevant and novel at the same time.

The Potential for Leadership

My favorite component of 3D printing implementation in an elementary school setting has been the formation of student teams and watching them train staff, prepare instructional YouTube videos and liaise with local businesses whom we've partnered with. These experiences transcend technology and capture the elusive goal of students defining their own learning trajectories.

Change is difficult, but the world described here is the only one our students will ever know. They need innovation, and what seems exotic today will become the mundane tomorrow. Please feel free to connect with me at carl_bull@wecdsb.on.ca or [@carl_bull](https://twitter.com/carl_bull) on Twitter to further our conversation.

Good luck with your own tech adventure!