

This week I will be reading through different articles discussing 3D printers and their applications. I will be going over what other people have done in this field. This will give us a better idea at what the technology can do, how it has been implemented in other studies, and for its usefulness as a teaching tool.

### **3D printing for children: What to build next?**

#### **Summary**

Three-dimensional printers are an extremely popular topic right now. This is due to the recent low-cost 3D printers that are now on the market. There are striking parallels between the advent of the 3D printer and that of the home computer. One parallel that is worth noting is the interest that is sparked by these technologies in children. There are challenges though that have to be overcome:

- first you have to "expand the range of physical media available for printing"
- second you have to "incorporate ideas derived from 'pick-and place' mechanisms into 3D printing"
- third you have to "explore methods for creating portable and ubiquitous printing devices"
- fourth you have to "create tools for hand-customizations, and finishing tangible printed objects"
- last you have to "devise software techniques for specifying, altering, and combining 3D elements in the context of printing"(pg 8).

The main printing medium for home based projects is ABS plastic which can only be printed out one colour at a time. This is not very appealing to children if they want to print multi-colored objects, or objects that have different textures. Therefore for affordable 3D printing geared towards children, the materials that can be used have to be expanded. This can be seen with 3D printers that print with chocolate. A bigger change, rather than changing the material, is changing the way a 3D printer prints. Instead of it printing a solid object in one stream, it would print out small discrete units that when put together form the object. Implementing a pick and place type mechanism in 3D printers would allow children to build objects just like this. The article suggested some people might think this may take out the actual learning aspect of how to build something. However, if they are able to print out certain parts that could not be made by hand normally, then put these parts together separately, it can be argued that a 3D printer would be extremely beneficial.

Printers may get smaller over time which for children is a good thing. A smaller printer could allow them to create small objects relatively fast, such as being able to print something in a museum visit, and have it small enough to be unobtrusively put in a larger display. For different children's projects tools need to be created for them such that after a model is printed, they can add detail to the model such that their models are more realistic. Creating these tools would benefit children as they could bring their already printed models to life, and leaving them with a memento of the experience.

One of the biggest challenges that children face when using 3D printers is the software associated with creating their models, and how complicated some of them are. Creating software that can allow for printing a complex shape in simple parts that can be assembled later also has other benefits. It makes the process of making the model easier, as you would not have to use supports during its construction. But why look at these problems now, and why address them now? Gearing 3D printers towards children in the end encourages developers to think about aesthetics and accessibility, which in the long run would be beneficial for everyone.

## **Quotes**

"Three-dimensional fabrication -- or 3D printing, as it is often called -- is clearly a (if not the) technology of the moment"(pg. 7)

## **Technology in Mathematics Education: Tapping into Visions of the Future**

### **Summary**

Three-dimensional printers are exceptional tools when it comes to teaching math. You can create a 3D model of the object, print it out, and have a tangible object to hold and understand. This technology can allow for the replication of things such as, "one-of-a-kind cast iron models created in the 19<sup>th</sup> century which aid in teaching and learning kinematics"(pg 353). This can allow students to learn about the object and how it works by manipulating different constraints and then seeing the effects on the object in real life instead of a 3D space.

## **Quotes**

"Students can explore three-dimensional objects in ways similar to how today's students use graphing calculators to explore families and functions. They can alter constraints and see the effects on the resulting objects"(pg 354).

## **Thinking like Archimedes with a 3D Printer**

### **Summary**

Archimedes was a brilliant mathematician and engineer who was able to come up with extremely complicated formulas for models. In this paper the researchers created various 3D printed models of his work. They were interested to see if the plans could indeed be printed out and functional, allowing them to have physical proof of Archimedes work. Three-dimensional printing lets the user quickly create a prototype of a design allowing the user to see if his ideas work or not. The user then can go back and fix their work until a finished product is achieved, in less time. This allows for a very hands-on experience which is a great way for students to learn about mathematics. Some mathematical concepts can't be easily understood without a model to base your ideas off. The article ends with tips when dealing with 3D printing in education on page fourteen and fifteen.

## **Quotes**

"The technology is fantastic to illustrate concepts in calculus. One of us (E.S.) has taught part of a lecture at Harvard using this technology".(pg 13)

## **A New Open Source 3D-printable Mobile Robotic Platform for Education**

### **Summary**

Three-Dimensional printers are a big advancement when it comes to making small mobile robots. It allows for the printing of parts extremely fast and cheap, allowing students to customize their own robots and come up with modifications that they can actually employ in a class. This would eliminate the need for having to wait for the regular expensive process. Printers would make teaching robotics a lot easier. Teachers can prototype models extremely fast for low cost. It would be easier to reconfigure the prototype, you can share designs among others, and it motivates students to develop their own platforms. The authors results state that they were able to print off their robot designs and have them working with a total cost of 57 euros and only about a 3 hour print time. It is easy to see how 3D printing of parts can really help with the education of students in robotic type classes. The problem with projects like these that are already on the market, such as LEGO MindStorms is that the software is not open source and you have to follow the guideline set out by the manufacturers.

## Quotes

"Mobile robotics is increasingly entering the curricula of many technical studies. Robotics is gaining terrain in industry and consequently more firms are recruiting candidates with experience in robot programming."(pg. 1)

## Biography

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[https://www.youtube.com/watch?v=6r5q9T\\_7u8A](https://www.youtube.com/watch?v=6r5q9T_7u8A)