# 3D Printer Project – June 2014

## The idea

We were given a 3D printer and funding for CPD to investigate how a 3D printer could be integrated and implemented into the teaching of DT, Science and Maths.

The proposal we sent to the NCTL was as follows:

## 3D Printer proposal

### Projects

We plan to use the printer with a number of year groups, primarily within DT lessons. The printer will be based in the DT CAD/CAM suite. This facility has a class set of computers and a range of existing CAD/CAM equipment.

#### Y10 Increase engagement with Science and Product Design

- In Year 10 Physics lessons we can use the 3D printer to make passive amps whilst studying sound waves, produce lenses to show the shape of them and the difficulties in producing them
- This will increase engagement with Physics as it allows students to design and produce products. They will be inspired by the use of cutting-edge technology within their science lessons and start to see links between Product Design and Physics.
- This will help to decrease the gender gap in Physics as girls will be interested in the applications
- Deborah Bicknell will be responsible for the project
- Staff will use the first term to familiarise themselves with the equipment and develop resources
- Students will undertake the project in the last half-term before summer.
- Training cost: 2 teaching staff (plus technician) to take 2 days training. £5.00 for material
- Cost of materials: (100 x £0.50) £50.00

#### Y9 Increase engagement with Science

- In year 9 Physics lessons we can use the 3D printer with less able science sets to allow them to design and produce different shapes to test whether they are streamlined.
- This will allow students to be creative and develop their ideas. They will start to see cross-curricular links with Product Design and it will increase their motivation in the subject as they are trusted to use a new piece of technology.
- Deborah Bicknell will be responsible for the project
- Staff will use the first term to familiarise themselves with the equipment and develop resources
- Students will undertake the project in the last half-term before summer.
- Training cost: 2 teaching staff (plus technician) to take 2 days training. £5.00 for material

- Cost of materials: (90 x £2.00) £180.00

## Y9 Realising their designs in DT

- In Year 9 Product Design lessons, we plan to use the 3D to allow students to realise their 3D CAD designs.
- This will provide opportunities for students for a real application and give them the opportunity to see their designs as high-quality finished products.
- The use of 3D printing will inspire high ability students who are interested in the technical aspects of DT and problem solving. It will help address the gender gap in take up of GCSE DT by inspiring girls.
- To assess the impact of the project, increases in take up at GCSE from more able students and a narrowing of the gender gap will be measured by comparing Y10 DT classes for 2014-15 and 2015-16 with 2012-13 and 2013-14. FFT targets for Maths, Science, English and DT will be used. The gender gap will be measured over the same timescale
- Michael Cronk will be responsible for the project
- Staff training at the beginning of the spring term 2014.
- Students will undertake the project in the second half of the spring term.
- Training cost: 3 teaching staff (plus technician) to take 2 days training. £5.00 for material
- Cost of materials: (100 x £0.50) £50.00

## Y12 rapid prototyping in DT

- We plan to use the 3D printer to enable the Y12 students to prototype their designs
- This will encourage them to try out their ideas with more accurate models.
- The use of the 3D printer will inspire them to push their design thinking and take risks and there should be an increase in attainment in the designing section of the A2 coursework. In addition, retention of students from AS to A2 should be improved.
- To assess the impact of the project, moderated marks allocated for the designing section of the A2 coursework will be compared for the 2015 entry with the 2013 and 2014 entries.
- Michael Cronk will be responsible for the project
- Staff training at the beginning of the Summer term 2014
- Students will use the 3D printer in the summer term, after returning from exam leave.
- Review of impact will take place after the A2 coursework has been marked in April 2015.
- Training cost: 2 teaching staff (plus technician) to take 2 days training. Material cost: £20.00
- Cost of materials: (6 x £3.00) £18.00

## Y8 understanding of tessellation in Maths

- We plan to use the printer to extend their understanding of tessellation in years 7 and 8 to exploring how tessellation extending would work in 3D. This would allow extension for those who quickly visualise and understand concepts.
- This will encourage better attainment in KS3 and GCSE of middle ability students that would be grade C or B at GCSE.

- Measuring success by student feedback and short video clips from students explaining how the models helped them conceptually and made them more interested in Maths. Also analysis of 2015 KS3 SATS scores.
- John Mould will be responsible for the project
- Staff will undertake training at the end of the spring term 2014
- Students will use the 3D printer at the start of the summer term
- No idea re size of print outs -say A4 or A5 models so big enough to see and play with.
- Review of impact will take place after the A2 coursework has been marked in April 2015.
- Training cost: 2 teaching staff to take 2 days training. 2 hours cascading to the department. Material cost for training: £20.00
- Cost of materials: (60 x £1.00) £60.00

Once set up, all the projects can run within department capitations.

### CPD

We plan to publish packs on the teaching school website to enable other schools to carry out the projects. These will include:

- Schemes of work
- Example files for use with a 3D printer
- Photographs of exemplar work

In addition we will offer CPD sessions for staff from the teaching school alliance and other schools.

### Project management

Overall, the project will be run by Michael Cronk:

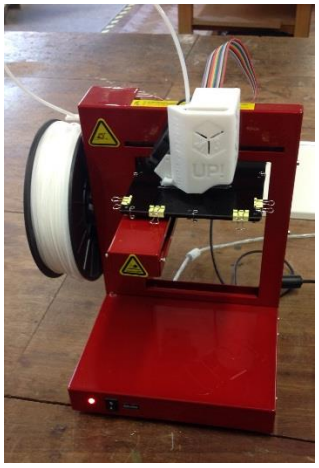
Email: mcronk@woodroffe.dorset.sch.uk
Phone: 01297 442232

Michael has experience of working with a range of CAD solid modeling packages including Pro/DESKTOP and SolidWorks. He is currently experimenting with Solid Edge ST5. In addition, a number of staff and most students in the school are familiar with Google SketchUp and we have successfully used 3D models produced in this to run CAD/CAM machines.

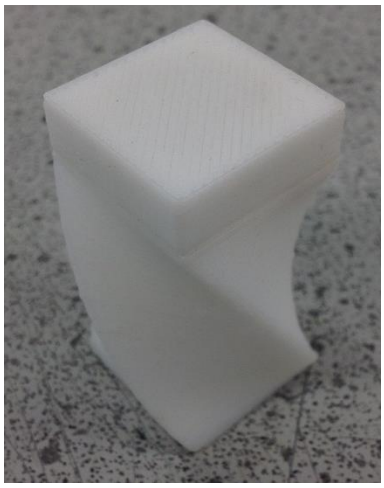
## The outcomes

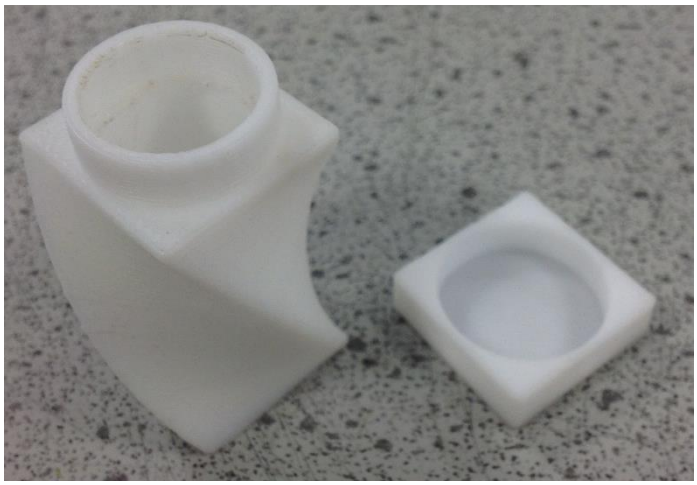
The printer arrived in February 2014 and it was put to use on the day of arrival. The machine was very simple to set up. After the software was loaded onto a computer up was simple procedure to set up the machine.

The printer printing its first object:



On the previous day I created the first object using Pro/DESKTOP 8. I saved the file as an STL file and loaded the file into the UP software. The software placed the object and worked out any necessary support material. The machine then printed out our first 3D object in 45 minutes.

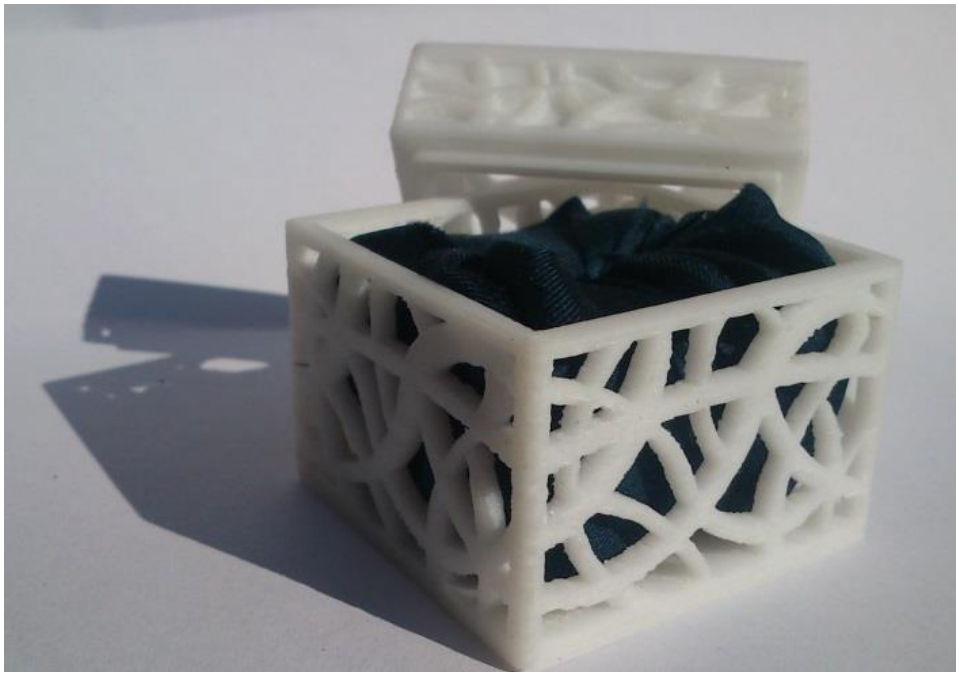




## Sixth form rapid prototyping – March 2014

As per our proposal, we then worked with our sixth form DT students to prototype their ideas. They quickly took to this, using both Pro/DESKTOP and SketchUp to create models. They found that there was a higher success rate with models created in Pro/DESKTOP. This is because SketchUp is a surface modelling tool whilst Pro/DESKTOP is a solid modelling tool.

Here are some examples of early work:



Ring box created in SketchUp

Passive amp created in Pro/DESKTOP (sand cast aluminium part was made with pattern made on the 3D printer)

## STEM Club – April 2014

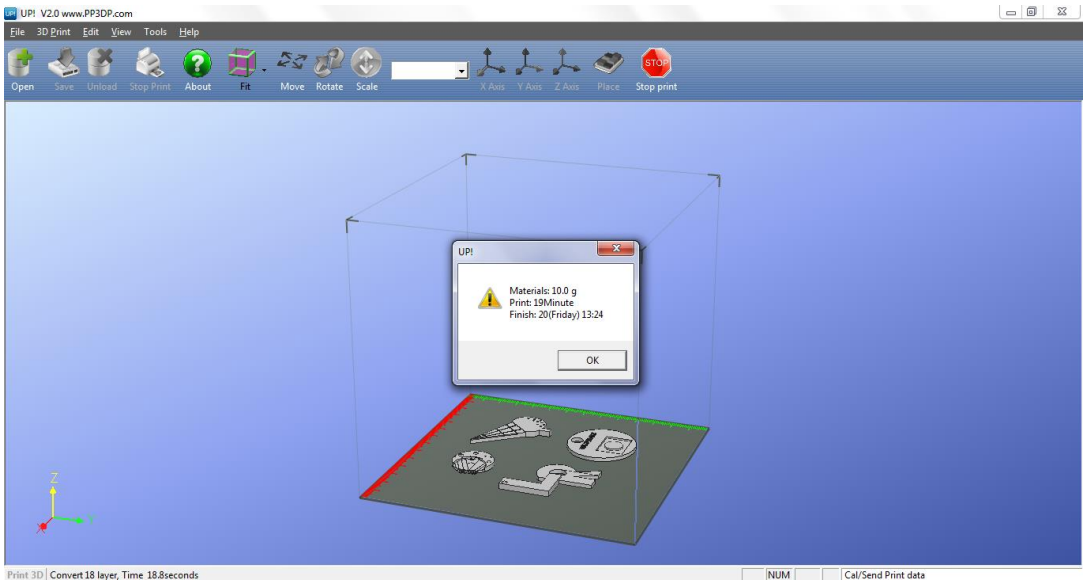
We introduced the 3D printer to the Y8 and 9 STEM club. They were very keen to try using it. They were set a challenge of creating interlocking 'impossible' shapes. This proved challenging but through trial and error, some interesting shapes were created.

Example of 3 interlocking rings:

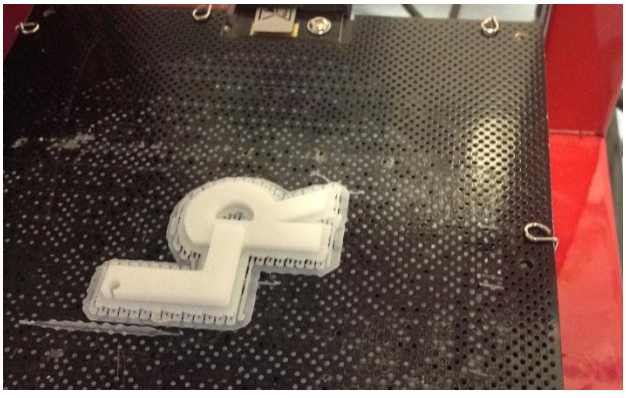
## Y9 Realising their designs in DT – May 2014

Before Easter, the DT department spent half a day training on the use of the 3D printer. We then introduced the printer to Year 9. They were highly motivated by it and keen to see their designs realised. We used SketchUp with them as they were familiar with this package. There were some issues with shapes not printing correctly but the UP software highlighted potential issues through colour when models were opened. We were able to print several keyrings at once due to their size. This reduced the amount of time setting up and therefore the time students had to wait for their products. Nevertheless there was some waiting and we included an extension task to allow for this.

Screenshot showing 4 keyrings arranged for printing with window showing how long the print will take and how much material will be used




Keyrings:



## Training of Maths and Science staff – June 2014

At the end of June, Michael Cronk trained Sabina Masaon and John Mould from the Maths department and Debbie Bicknell from the Science department on using the 3D printer. They are trailing using the printer in their lessons this term with a view to cascading to their departments in the autumn term.