Rapid Learners

RAPID PROTOTYPING HELPS LAKE ZURICH HIGH SCHOOL STUDENTS MAKE THEIR DESIGNS COME ALIVE

"The Dimension 3D Printer has improved many aspects of our students' learning experience."

– John Keyzer, Lake Zurich High School

CASE STUDY

Game controller built from components made with the 3D printer.

Students at Lake Zurich High School in Lake Zurich, Illinois have long been designing interesting buildings, mechanical assemblies and consumer products for class projects, as well as robots for the FIRST® competition. But until recently, the ability of the students to actually see and touch these designs was very limited. Students were able to build only a few of the simplest projects.

The visual appearance of complex objects is very difficult to get exactly right on the computer, so students had no way of knowing exactly how their designs looked, how they felt in their hands or whether they fit together with other parts. Components for the robots were built by machine shops, which was expensive, took considerable leadtime and often resulted in parts that were heavier than necessary.

John Keyzer, Technology Education Teacher at Lake Zurich High School, was at the Society of Manufacturing Engineers' (SME) RAPID Conference where he and a group of his students participated in the Bright Minds mentoring program. Bright Minds is designed to introduce students to rapid prototyping and additive manufacturing as a possible career path. The school received a grant for the use of a Dimension BST 1200 3D Printer for a year.

"We quickly discovered how easy it is to turn a CAD model into a rapid prototype that often has the physical appearance and mechanical properties suitable for a finished part," Keyzer said. "Students simply export an STL file and send it through the network to the printer. There's no messy cleanup like with powder-based systems. The finished parts are tough ABS plastic so no finishing is required for strength."

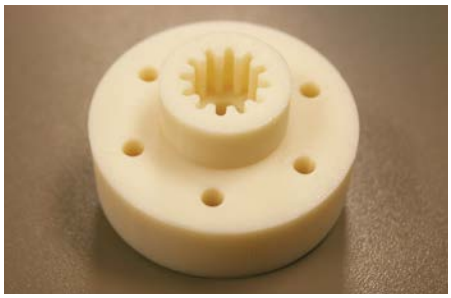
Now, when students design projects they are able to print out what they are working on. Building a prototype forces students to resolve issues that are too easy to gloss over with a computer model. They can see, touch and feel the subtle changes in a curve or line, such as looking at the way light reflects off its surface from any angle.

For example, students researched a sample of 14 to 18-year-olds to find out what they were looking for in a game controller. They then designed and built prototypes using 3D printer parts to determine whether or not they had met their objectives. They were able to determine: how the parts fit together to form an assembly, how the controller fits in a student's hand, how the controller looks in the environment in which it will actually be used, and what type of results students were able to achieve on their favorite games.

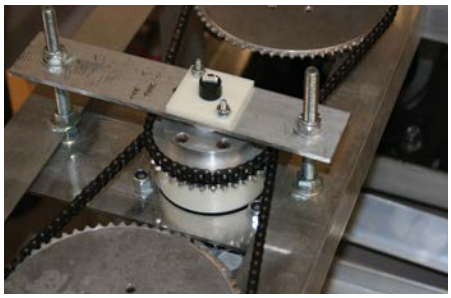
In the past, parts designed for the school's FIRST robot often didn't fit right or work right. It took a week to have a new metal part built at a cost of about $200. Now students make rapid prototypes in one day. They make sure the parts fit, perform their intended function and have the right appearance. Some parts are still made by a machine shop, but others built on the 3D printer are used directly in the robot. Time to make these parts is only one day and the cost is $50.

An example of the robot parts made by students with the 3D printer is a steering coupler that connects the steering motor and hub. The ABS part weighs only 6 oz. compared to 16 oz. for an aluminum part which provides an important competitive advantage. "The 3D printer has improved many aspects of our students' learning experience," Keyzer said. "When our grant expired we purchased it without any hesitation."

Lake Zurich high school students designed game controller shown here in CAD rendering.



Students designed steering coupler, built on 3D printer and used in their robot for competitions.



Students had problems with an off-the-shelf encoder mount so they designed and built a replacement (square white part) and also used it in their robot.

How Does 3D Printing Compare to Traditional Methods for Lake Zurich High School?

METHOD	COST	LEAD TIME	WEIGHT
Machine shop	$200	7 days	16 oz
3D Printing	$520	1 day	6 oz
Savings	$148 (74%)	6 days (86%)	10 oz (63%)

stratasys

E info@stratasys.com / STRATASYS.COM

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HEADQUARTERS
7665 Commerce Way, Eden Prairie, MN 55344
+1 888 480 3548 (US Toll Free)
+1 952 937 3000 (Intl)
+1 952 937 0070 (Fax)

2 Holtzman St., Science Park, PO Box 2496
Rehovot 76124, Israel
+972 74 745-4000
+972 74 745-5000 (Fax)