Harrow School

HARROW SCHOOL

Autodesk Inventor provides a cool solution

By taking part in the Engineering Education Scheme, four pupils at Harrow School were able to design a water cooler which avoids the need for lifting heavy bottles. Proposed designs were investigated using Autodesk Inventor before a final solution was selected. Autodesk Inventor not only enabled the pupils to solve complex design problems but also produced impressive rendered images to illustrate the 50-page project report.

"Man and Machine are an extremely helpful company and enthusiastic about what they're doing. That really transferred to the boys."

Dr Simon Flatres
Physics Teacher

Harrow School

If you want to inspire pupils to learn, the best way to do it is to let them solve real world problems. Thanks to an Engineering Education Scheme project supported by Autodesk and Man and Machine, four Harrow School pupils have done just that. By applying their theoretical knowledge and using Autodesk Inventor to produce digital prototypes, they have designed an innovative water cooler which avoids lifting heavy refill bottles.

Founded in 1572, Harrow School in north west London is one of Britain's leading independent schools. It offers a high quality boarding school education for 800 boys.

For some of the brightest pupils studying physics in the Lower Sixth (Year 12), the scheme is an annual opportunity to engage in an intellectual challenge. "Boys are very eager to get onto the Engineering Education Scheme, so it's quite competitive," says physics teacher **Dr Simon Flatres.**

In November 2009, eight Harrow School boys were chosen to compete in two teams of four. One team tackled a project involving fluid dynamics. The other had to design a new water cooler to avoid the strain of lifting a heavy water bottle into an inverted position. The project offered experience in engineering, design and research at a professional level.

Although building a working prototype was not required, good 3D design and visualisation were vital. That meant using Autodesk Inventor.

Bringing Designs To Life

"Autodesk Inventor gives you the ability to see what your project is going to look like without ever having to leave your computer," says **Dr Flatres.** "But that still left the problem of actually learning how to use the software."

Autodesk provides free software for educational use, enabling the school to download full copies. Man and Machine is the authorised UK distributor of Autodesk's software for education, while both companies sponsor the Engineering Education Scheme. A day's software training proved an excellent beginning.

"The way that Man and Machine took the boys from a standing start to a level where they could design complex 3D structures in one day was massively impressive" says **Dr Flatres.**

The pupils quickly thought of ideas to lift heavy water bottles into position or, more simply, to pump the water up from below. They then explored the general principles and main design features with Autodesk Inventor being used to solve real world issues. For example, an idea of a spring lifting system to raise the water bottle was designed but dismissed as very expensive.

Autodesk Inventor came into its own when designing the final pumping solution. Described by Dr Flatres as "stunningly visual", the software allows the physical dimensions of a component to be changed in seconds. Intuitive snap-together and pull-apart features quickly isolated problems while rendering and animations brought the design to life.

Autodesk®

Harrow School

Engineering Education Scheme

Engineering Education Scheme

Run by the Engineering Development Trust, the Engineering Education Scheme for England and Scotland links Lower Sixth (Year 12) pupils and teachers with local companies to work on real scientific, engineering and technological problems. Around 1,400 pupils participate in an annual six month project with almost nine out of ten subsequently taking engineering or associated science/IT/technical degrees. Autodesk is a sponsor of the Engineering Education Scheme.

"Autodesk Inventor allowed us to refine our ideas and optimise our final solution. We could make quite big changes very quickly to the way the water cooler appeared," he says.

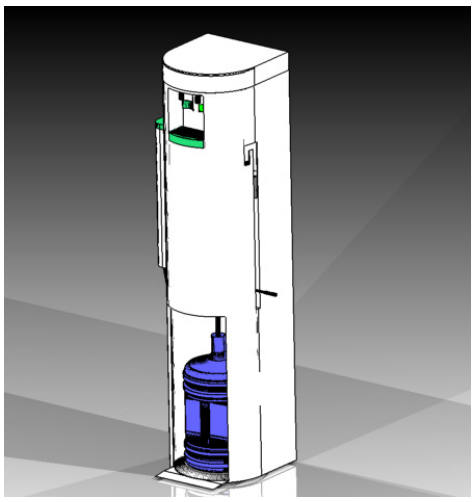
During the six month project, Harrow School was given full software support from Man and Machine. This included take-home exercises from the training day as well as regular telephone and email contact. Many 'how do we do this?' type questions were answered with "very helpful" advice.

A three-day workshop at the University of Surrey in January 2010 helped the pupils learn from engineers, teachers and academics to develop their design concepts. Man and Machine also showed them how to mock up these designs and to output information for the final project report.

"Man and Machine were really helpful for the advanced use of Autodesk Inventor," **Dr Flatres** notes. "The workshop helped polish the project."

Inspiring the next generation

The completed design involves sliding a water bottle upright into the bottom of the cooler, manually lowering a large hollow needle to penetrate the cap and automatically pumping the water up into a small reservoir for cooling. The needle's precision operation was inspired by a door barrel latch.



During experimentation, a car windscreen washer motor proved a suitable pump. The pupils then devised a formula to calculate how long it would take to fill a cup from the reservoir.

As the project report neared completion, Man and Machine gave useful advice on rendering techniques and animations. Designs included the latch with a stainless steel needle, a reservoir with sensors and control electronics.

In April 2010, the project was completed with a formal presentation to an assessment panel. According to Dr Flatres, the assessors "really liked" the project and thought it was "an innovative and feasible solution".

Discovering more about real world engineering with Autodesk Inventor left all the pupils seriously considering engineering degrees. From a physics teacher's point of view, their "extremely good" project usefully combined several A-level topics.

"The boys see that the skills that they're learning are being used by current engineers and they really get excited about it. Harrow School has a very good track record of sending boys off to do engineering degrees too," says **Dr Flatres.**

"We would like to thank Demir Ali, our mentor engineer from Man and Machine, who gave us all an induction course in the use of Autodesk and without whom this project would not have been possible."

Harrow School Lower Sixth pupils