3D in Education

About 30 Freemen gathered at Claridges' Hotel for a breakfast meeting hosted by Texas Instruments. The subject was the presentation of the findings of a research project on the impact of 3D on pupils' learning. Known as the "Learning in Future Education" or "LiFE" project, the team of researchers led by Freeman Professor Dr Anne Bamford, Director of the International Research Agency aimed to determine the most effective type of 3D experiences and to measure the value and impact of these experiences on pupil learning and achievement. The pilot research also examined learning strategies and teaching processes and measured the meaningful impact on educational outcomes. The Upper Warden Martin Cross, Chair of the Education Committee, chaired the meeting to which several journalists had also been invited.

Anne Bamford presented the results of the study. The research project involved 740 students, 47 teachers and 15 schools across France, Germany, Italy, Netherlands, Turkey, United Kingdom and Sweden and took place October 2010 – May 2011. Equality of access is the law in Europe so the schools included children from different backgrounds and with learning or behavioral challenges integrated into the general classes. The 15 schools in the study were selected on the basis of direct contact as well as from recommendations by local education authorities. They covered a range of different types of schools including both private and public funded schools. The study focused on pupils between the ages of 10-13 years learning science-related content. Both experienced and less experienced teachers were involved.

Results were gathered on how pupils understood the concepts being presented and the differences noted between 2D and 3D presentation. Researchers collected quantitative and qualitative data based on multiple interactions within each classroom. For the quantitative tests, pupils were tested before and after the lessons with a "control" group learning in 2D only and the other group receiving the same instruction plus 3D. Pupils were also tested on their ability to retain and reinterpret the information through an open-ended task. The results of the study showed consistent reporting of improved test scores. On average**,** 86% of pupils improved from the pre-test to the post-test in the 3D classes, compared to 52% who improved in the 2D classes. Individuals improved test scores on average 17% in the 3D classes, compared to an 8% improvement in the 2D classes between pre-test and post-test.

There were also behavioral and communication changes and improved classroom interaction. For example 92% of pupils on average were attentive during the 3D part of the lesson while only 46% were actively paying attention during the non-3D part of the lessons. The rate of 'on-task' conversation and questions from pupils increased after the 3D part of the lesson. Pupils were highly motivated and keen to learn through a 3D approach. The teachers found that the use of the 3D technology led to a deepening of pupils' understanding, increased attention spans, more motivation and engagement. The pupils in the 3D class were more likely to recall detail and sequence of processes in recall testing than the 2D group. The 3D pupils were also more likely to perform better in open-ended and modeling tasks.

Teachers within the LiFE project found it easy to integrate 3D technology into their regular lessons with 6 out of the 15 schools also modifying teaching and learning pedagogy in response to the introduction of 3D. Teachers felt that 3D animations allowed them to teach topics in more depth and less time than conventional teaching methods. The teachers and pupils proposed ways that 3D could be successfully integrated across the curriculum. Parents indicated strong support for the introduction of 3D into the classroom. There was acknowledgement that 3D offered enormous potential to enhance pupils learning and retention and that it should be available at home as well as at school.

While the overall results of this initial research study indicate strong evidence of a positive impact on 3D animations on pupils' learning and classroom interactions, further research is needed on the design and usability of the interactive glasses. Models of innovative pedagogy and learning examples are also needed to continue to reflect on the effectiveness of the new technology on learning now and into the future.

Further details about the practical implications of the study were given by Kathryn Macaulay the Deputy Head of the Abbey School in Reading which was one of the schools in the pilot study. The teacher becomes the guide to the learning experience as the pupils are motivated by the experience and want to go on to learn more themselves. The teacher therefore needs to manage the experience well. She also stressed that many projectors already in schools already have 3D capability and there is free software available from the Internet. The main cost at present is the 3D glasses but this is falling all the time.

The third speaker was John Reder from Texas Instruments in the USA who gave a brief overview of how new technologies such as 3D and interactivity can benefit both pupils and teachers. Although Texas Instruments were the lead other technology providers collaborated on this research.

An example of 3D technology was given to everyone who put on the special glasses to see the 3D images. There was also a number of computers available in the adjacent room for those who wanted to explore aspects further.

A lively discussion followed after the presentations. The following points were raised:

- The class sizes in the study varied from 24-37 typically although in Sweden a small remote rural school was included.
- The classes with only 2D experiences had 3D models of a heart for example. In France one class had an actual sheep's heart as well.
- The 3D technology can be helpful in Chemistry and Physics with both cost savings and removal of some health and safety aspects. However, it is important that pupils also do some actual experiments themselves.
- The pupils themselves came up with a lot of ideas as to how the technology might be used going forward.
- The key person in the classroom is the teacher who must manage and provide a structured learning experience. Even the best technology cannot replace a good teacher. It is important that staff are given the chance to develop ideas on the use of technology.

- One key issue for teachers is whether the technology will work when it is switched on. Reliability is improving but there are still parts of the UK where the band width is still poor. The batteries in the glasses need to be changed regularly.
- Teachers wanted more of the 3D availability than did the pupils who were happy to dip in and out if its use.
- Pupils commented that the teachers ‘became nicer’ when using the 3D technology.
- Some pupils are making their own models as a result of the 3D experience.
- The research was done on children aged 10-13. A next step would be to look at 3D use for younger children. The 3D technology seemed to work best when the first introduction for the children was through 3D.
- The technology appeared to work well with children who find concentration hard. There were less discipline issues in the classes where 3D was used.

The key message from the morning was that 3D technology gives the teacher another varied and effective tool to help pupils’ learning. However, the key is the good teacher who manages the learning experiences well.