

Do ICT simulations help the teaching of science ideas to 11–16 year olds?

Who wants to know?

Science teachers, science teacher trainers, policy makers and providers of continuing professional development (CPD).

What did we find?

- There were nine evaluation studies on the use of simulation to teach the understanding of science ideas that included a control and pre and post testing of achievement in the in-depth review. Seven of these were rated medium high or medium quality studies.
- Simulations fell into two main categories - simulation of specific experiments and simulations of a wider scientific situation, commonly known as virtual environments, which could include experimental simulations. Both types of simulation can improve students' understanding compared to non-ICT/traditional teaching and learning activities.
- Students' use of ICT simulations helped them to improve their understanding of science ideas more effectively compared to the use of non-ICT teaching activities.
- Students' use of ICT simulations was more effective than using non-ICT teaching activities for improving basic science ideas including science understanding and the scientific approach.
- However the improvement of higher levels of understanding (for example, the transfer of scientific knowledge from one situation to another and experimental design) can equally well be achieved when students use traditional (non-ICT) teaching approaches.
- The gains in students' learning when using ICT simulations were further enhanced when teachers actively scaffolded or guided students through the ICT simulations.

How did we get these results?

The review question was:

What is the effect of ICT teaching activities in science lessons on students' understanding of science ideas?

557 scientific papers on the use of ICT in science lessons, published in English in the period 2000 - 2005 were screened. These were narrowed down to 37 studies from 10 countries that focussed on ICT and scientific ideas. As the most frequent type of ICT used was simulations (53%), the in-depth review question was: What evidence is there from controlled trials of the effects of simulations on the understanding of science ideas demonstrated by students aged 11-16?

What are the implications?

There is no high quality evidence about the use of ICT to teach science ideas. However medium high and medium quality evidence demonstrate that simulations can be used successfully to teach science ideas including knowledge and science approach. Simulations can be particularly advantageous for basic scientific ideas and for less advanced scientific reasoners. Teachers' guidance can enhance the benefits of ICT simulations.

Where to find further information

The reference for this review is: Hogarth S, Bennett J, Lubben F, Campbell B, Robinson A, 'The effect of ICT teaching activities in science lessons on students' understanding of science ideas. In: Research Evidence in Education Library. London: EPPI-Centre, Social Science Research Unit, Institute of Education, University of London. This can be downloaded from <http://eppi.ioe.ac.uk/reel/>.

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Where to find further information

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The results of this systematic review are available in three formats:

SUMMARY

Explains the purpose of the review and the main messages from the research evidence

TECHNICAL REPORT

Includes the background, main findings, and full technical details of the review

DATABASES

Access to codings describing each research study included in the review

These can be downloaded or accessed at <http://eppi.ioe.ac.uk/>

Report published by the EPPI-Centre in November 2006.

The EPPI-Centre's reference number for the report of this review is 1412T. The full citation is:

Hogarth S, Bennett J, Lubben F, Campbell B, Robinson A (2006) ICT in Science Teaching. Technical Report. In: *Research Evidence in Education Library*. London: EPPI-Centre, Social Science Research Unit, Institute of Education, University of London.

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