A systematic review of the use of ICTs in developing pupils' understanding of algebraic ideas

The in-depth review question set out to answer:

How have different information and communication technologies (ICTs) contributed to the development of understanding of functions for pupils up to the age of 16?

Who wants to know and why?

The review has been commissioned by the Training and Development Agency for Schools (TDA) and focuses on algebraic functions. The TDA were interested in how ICT could contribute to pupil's understanding of algebraic functions and under what conditions that understanding developed.

What did we find?

There is evidence of:

- pupils achieving general gains of understanding
- students successfully using visualisation with graphing software to fit graphs to datasets, to solve equations and to transform functions.
- pupils working in a computer environment reached higher levels of thinking and were able to explain their thinking better than pupils working in a paper and pencil medium.
- lower attaining students preferring to work arithmetically with tables of values and only later moving to integrate the tables of values with computer generated graphs.
- pupils having difficulty with moving between symbolic, tabular and graphical forms when solving equations.
- students not always knowing how to use the technology, interpret ambiguities in the output or exercising critical judgment when using some of the advanced calculators.
- That small group and interactively working with teachers enabled ICTs to be used more effectively.
- students using ICT out of school being better able to use it effectively within school.

What are the implications?

- Teachers need to help pupils to use the technology critically so that they understand how to interpret mathematical output
- Teachers need to make links between functions represented symbolically, in tables and in graphs.
- Teachers need to negotiate a balance between the individual constructions which may develop when pupils work alone or in small groups with the technology, and common knowledge developed within the whole class.

How did we get these results?

Identifying relevant studies involved carrying out an electronic search, using keywords with bibliographic databases, and handsearching conference proceedings, citations and publications recommended by contacts. This resulted in 33 studies being identified for the systematic map and 14 for the in-depth review.

The **Evidence for Policy and Practice Information and Co-ordinating Centre** *(EPPI-Centre) is part of the Social Science Research Unit at the Institute of Education, University of London*

SUMMARY

Where to find further information

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

SUMMARY	**Explains the purpose of the review and the main messages from the research evidence**
REPORT	Describes the background and the findings of the review(s) but without full technical details of the methods used
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/reel/**

Reports published by the EPPI-Centre in May 2008.

The EPPI-Centre's reference numbers for the reports of this review are 1606T (Technical Report) and 1606R (Report). The full citations are:

TECHNICAL REPORT

Goulding M, Kyriacou C (2008) A systematic review of the use of ICTs in developing pupils' understanding of algebraic ideas. Technical report. In: *Research Evidence in Education Library*. London: EPPI-Centre, Social Science Research Unit, Institute of Education, University of London

REPORT

Goulding M, Kyriacou C (2008) A systematic review of the use of ICTs in developing pupils' understanding of algebraic ideas. Report. In: *Research Evidence in Education Library*. London: EPPI-Centre, Social Science Research Unit, Institute of Education, University of London