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Research Bibliography: Dynamic Geometry Software

Keith Jones

This bibliography lists research that has investigated the use of dynamic geometry software (DGS) in the teaching and learning of mathematics. The bibliography is not intended to be exhaustive; rather it includes the major studies across the range of research that has been published.

Arzarello, F., Olivero, F., Paola, D., and Robutti, O. (2002), A Cognitive Analysis of Dragging Practises in *Cabri* Environments. *International Reviews on Mathematical Education*, **34**(3), 66 – 72.
Proposes a theoretical description of how students make use of the dragging facility in one DGS package.

Jones, K. (2000), Providing a Foundation for Deductive Reasoning: students' interpretations when using dynamic geometry software. *Educational Studies in Mathematics*, **44**(1&2), 55-85.
Shows how students' explanations can evolve from imprecise, 'everyday' expressions, through reasoning that is overtly mediated by the software environment, to mathematical explanations of the geometric situation that transcend the particular tool being used. Suggests that this latter stage should help to provide a foundation on which to build further notions of deductive reasoning in mathematics.

Gawlick, T. (2002), On Dynamic Geometry Software in the Regular Classroom**.** *International Reviews on Mathematical Education*, **34**(3), 85 – 92.
Compares classes taught using DGS to those taught without using computers. The research design adopted failed to find major differences. The students who did gain from using the software were higher achieving girls in a mixed school.

Healy L. and Hoyles C. (2001), Software tools for geometrical problem solving: potential and pitfalls, *International Journal of Computers for Mathematical Learning*, **6**(3), 235-256.
Reports that while DGS can be used to help students move from argumentation to logical deduction, students' understanding of the proving process is closely interconnected with how they use the software.

Hadas, N., Hershkowitz, R. and Schwarz, B. B. (2000), The Role of Contradiction and Uncertainty in Promoting the Need To Prove in Dynamic Geometry Environments. *Educational Studies in Mathematics*, **44**(1&2), 127-150.
Shows how, with carefully designed activities, students can engage in the construction and evaluation of mathematics arguments in which they have to use their geometrical knowledge to explain contradictions and overcome uncertainty.

Hölzl, R. (1996): How does 'dragging' affect the learning of geometry? *International Journal of Computers for Mathematical Learning*, **1**(2), 169-187.
Hölzl, R. (2001): Using DGS to add Contrast to Geometric Situations – A Case Study, *International Journal of Computers for Mathematical Learning*, **6**(1), 63-86.
Two articles that provide interesting insight into how students use DGS.

Laborde, C. (2001), Integration of Technology in the Design of Geometry Tasks with *Cabri-Geometry*. *International Journal of Computers for Mathematical Learning*, **6**(3), 283-317.
Relates how long it can take to fully utilise the potential of DGS in the classroom.

Mariotti, M. A. (2000), Introduction to Proof: the mediation of a dynamic software environment. *Educational Studies in Mathematics*, **44**(1&2), 25-53.
Explores the various influences of DGS on student learning of geometry, especially the characteristics which make it possible to introduce students to theoretical thinking. Finds that this latter process is neither simple nor spontaneous.

Sträßer, R. (2001), Cabri-Geometre: Does Dynamic Geometry Software (DGS) Change Geometry and Its Teaching and Learning?

International Journal of Computers for Mathematical Learning, **6**(3), 319-333.
Explores how, with DGS, geometrical objects are transformed into computational objects. Concludes that this deeply changes geometry if geometry is taken as a human activity integrating the use of tools such as DGS.

Other useful books and reports

Hollebrands, K., Laborde, C., & Sträßer, R. (in preparation), The Learning of Geometry with Technology at the Secondary Level. In M. K. Heid & G. Blume (Eds.), *Handbook of Research on Technology in the Learning and Teaching of Mathematics: Mathematics Curriculum Development and Tool Development.* Greenwich/CT: Information Age.
Should provide a good overview of research on learning geometry with ICT.

King, J. R. and Schattschneider, D. (Eds) (1997), *Geometry turned on! Dynamic software in learning, teaching, and research*. Washington: Mathematical Association of America.
Gives many examples of the ways in which DGS can be used, and some of the effects it can have.

NCET (1996), *Dynamic Geometry*. Warwick: NCET.
Discusses and gives examples of classroom use of DGS. Two sections of the report are available online at:
http://curriculum.becta.org.uk/docserver.php?docid=1762

Research Bibliographies
Every year hundreds of teachers engage in classroom-based research for a variety of purposes. Sources of support for classroom-based research include:

BECTa ICT Research Bursary up to a maximum of £10,000, see:
http://www.becta.org.uk

DfES Best Practice Research Scholarships worth up to £2,500 each, see:
http://www.teachernet.gov.uk

DfES Professional Bursaries Scheme offers teachers in their fourth and fifth years of teaching a bursary of £500 to spend on their own professional development, see:
http://www.teachernet.gov.uk

NASUWT Teacher Research Grant Scheme of up to £3,000, see:
http://www.teachersunion.org.uk

NCSL Research Associate programme offers an opportunity for school leaders (headteachers, deputies and others in team leadership roles) to engage in research, see:
http://www.ncsl.org.uk

As more and more opportunities arise for teachers to get support for engaging with research, MicroMath is devoting a section to a series of *research bibliographies* designed to provide details of the most pertinent research on using particular ICT applications in the teaching and learning of mathematics.

Keith Jones works at the Centre for Research in Mathematics Education at the University of Southampton. He was a member of the RS/JMC inquiry into the teaching and learning of geometry and he organises the geometry working group of the British Society for Research into Learning Mathematics (BSRLM), see:
http://www.crme.soton.ac.uk