

Research on Dynamic Geometry Software (DGS) - an introduction

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Abstract: The introduction briefly describes the characteristic features of Dynamic Geometry Software (DGS) to give the main reasons for the selection of papers in this ZDM-volume. Research on every characteristic DGS-feature (dragmode, macro-constructions, locus of points) is presented in one paper from an author having done research on the feature. The last paper describes an example of classroom research on DGS.

Kurzreferat: Die Einleitung beschreibt die Charakteristika (Zugmodus, Makro-Konstruktion, Ortslinie) des Software-Typs "Dynamische Geometrie Software (DGS)" und erklärt so die Konzeption dieses Heftes. Je ein Beitrag stellt nämlich Forschungen zu einem dieser Charakteristika dar, während der letzte Beitrag Ergebnisse einer Untersuchung zum unterrichtlichen Einsatz von DGS berichtet.

ZDM-Classifikation: C70, G10, N80, U70

"Dynamic Geometry Software (DGS)" throughout this volume is used as a generic term to describe a certain type of software which is predominantly used for the construction and analysis of tasks and problems in elementary geometry. The first exemplar of this type of software – Cabri-géomètre - was presented at the ICME-6-conference in Budapest in 1988. Since then, a whole variety of pieces of analogous software was brought into the schools and the "market" at large – like GEOLOG, Geometry Inventor, Geometer's Sketchpad and Thales to give but a few examples.

Since the start more than two decades ago, DGS has become one of the most widely used pieces of software in schools and colleges all over the world. There are versions in a large number of different languages (from English, French, German, Japanese and Spanish to "small" ones like Swedish). If viewed in terms of research on software use in teaching and learning mathematics, DGS may be one of the best (if not the best) researched type of software within Didactics of Mathematics (mathematics education research). At least for Geometry in secondary schools (grade 5 to 10), it definitely is the type of software research offers most insights about (see Hollebrands et al. in print).

A widely accepted description of Dynamic Geometry Software is given in the joint paper on Didactics of Geometry published in the German research journal "Journal für Mathematikdidaktik (JMD)" some six years ago: "Even if the ... programs differ in their conceptual and ergonomic design, they share

- a dynamic model of Euclidean school Geometry and its tools (the dragmode),
- the ability to group a sequence of construction commands into a new command (macro-constructions),
- the visualisation of the trace of points which move depending on the movement of other points (locus of points"; see Graumann et al. 1996, p. 197; translation RS).

As a consequence of this definition, the present volume has three papers on research focussing on the three characteristic features of DGS, namely dragmode (see the paper by Arzarello et al.), macro-constructions (Kadunz) and locus of points (Jahn). The last paper by Gawlick somehow marks a new brand of research on DGS: With more than 20 years of existence, Didactics of Mathematics does not restrict its research to a more or less individualistic perspective on DGS use - and Arzarello et al. on dragmode in its concluding remarks already breaks out of these limitations by pointing to the importance of the role of the teacher in the learning with the help of DGS. From the very beginning, the research reported in the paper by Gawlick tries to better understand the role of DGS in classroom learning with the help of this type of software.

Reading the papers of this volume a comment on research methods comes to mind. From the papers in this volume it is obvious that a certain "eclecticism" may be helpful to fully analyse - maybe even understand - the problems and potentials of Dynamic Geometry Software. The analysis of the mathematical potential of the software - see the paper by Kadunz which mirrors the absence of empirical research on macros - can be as revealing as a traditional statistical study like the one by Gawlick or the analysis of prototypic learning processes (see the paper by Jahn) and a heavy investment in terms of theory as in the paper of Arzarello et al. There may be even additional methods to be used to fully understand the potential and pitfalls of Dynamic Geometry Software (DGS).

Apart from different research methods and research foci, all four papers agree on a conclusion explicitly stated by Arzarello et al.: It is a misbelief to think "if the technology used is good, then didactics will certainly improve". A lot of analytic and constructive work is still to be done to make use of DGS a success story in teaching and learning mathematics, especially Geometry.

References

- Graumann, G., Hölzl, R., Krainer, K., Neubrand, M., & Struve, H. (1996). Tendenzen der Geometriedidaktik der letzten 20 Jahre. *Journal für Mathematikdidaktik*, 17(3/4), 163 - 237.
- Hollebrands, K., Laborde, C., & Straesser, R. (2003; 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: Syntheses and Perspectives*. Greenwich/CT: Information Age.

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