CURRENT REPORT

Dynamic Geometry Software: The Teacher's Role in Facilitating Instrumental Genesis

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Currently Dynamic Geometry Software (DGS) has made little impact in the UK. Classroom use has remained limited despite recommendations in the Key Stage 3 Mathematics Framework for using DGS to develop geometrical reasoning (Ofsted 2004). Research generally favours the strong potential of DGS but fails to explain the poor reality of classroom use. Lagrange et al (2003) paint a picture of research on Information and Communication Technology (ICT) in mathematics education as a field dominated by "publications about innovative use". In particular, the role of the teacher was notably absent. Although research has begun to examine the role of the teacher in DGS integration, the practices of ordinary teachers in ordinary classrooms remains an area requiring further investigation (Lagrange 2008). The author carried out the study in the role of a practitioner-researcher with a high attaining year 8 class. This study aims to address the perceived gap in research in the sense that it analyses the practices of an ordinary teacher in an ordinary classroom.

The instrumental approach was used to analyse teacher/pupil interactions in order to elicit teaching strategies which might facilitate pupils' instrumental genesis. Instrumental genesis is described as the process by which an artefact is transformed into an instrument by the subject or user (Guin and Trouche 1999). An artefact is a material or abstract object, given to a subject. An instrument is a psychological construct built from the artefact by the subject internalising its constraints, resources and procedures (Guin and Trouche 1999). Once the user has achieved instrumentalisation, he is able to reinterpret or reflect on the activity he is engaged in.

Data was drawn from a sequence of 5 lessons in which pupils, working in pairs, investigated a series of construction problems using Cabri Geometre, based upon tasks developed by Jones (2000). During the lessons, the researcher carried an audiotape so that teacher/pupil interactions would be recorded. By analysing teacher/pupil interactions in a DGS context, elements of instrumental genesis were distinguished in pupils' dialogue and written work, from which strategies emerged that teachers could employ to facilitate this process. The strategies were:

- Unravelling functional dependency in DGS;
- Exploiting dynamic variation to highlight geometric invariance;
- Making connections between DGS and pencil-and-paper.

These teaching strategies essentially highlight general principles of mathematics teaching applied to a specific context, in this case DGS. The resource provides a context for learning but cannot teach. The focus of research needs to shift away from the context, towards teachers and their teaching strategies. For example, research needs to be explicit about what kinds of teaching strategies should be encouraged if teachers are to integrate DGS successfully into their classroom practice.

This begs the question: how *do* you encourage particular teaching strategies? The National Curriculum 2007 (QCA 2008) explicitly encourages more exploratory and discursive approaches in mathematics teaching. Further research will investigate the impact of the National Curriculum 2007 on the teaching and learning of mathematics, with a particular focus on ICT use. ICT represents a critical case because these resources provide rich opportunities for exploratory and discursive approaches. To date, teachers have perceived the benefits of ICT use mainly in terms of pace and productivity (Ruthven, Hennessy, and Brindley 2004). In contrast, given the increased interest in dialogic teaching implied in the new National Curriculum, a shift in teachers' perceptions of ICT use towards a rationale based on promoting discussion, exploration and creativity might be expected.

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