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BSRLM Geometry Working Group

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Contexts for Teaching Geometry

A report based on the meeting at the University of Birmingham, 14th October 1995

by

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With some notes contributed by Brian Hudson (Sheffield Hallam University) and Steve Downes (Mayfield School, Portsmouth).

This report of a meeting of the geometry working group considers what it means to educate someone geometrically and what are useful contexts in which to consider geometry. An undergraduate unit on symmetry is described and this leads to the discussion of context. The relationship between geometry and algebra is briefly mentioned.

At this meeting, the working group considered two issues:

- what it means to educate someone geometrically
- what are useful contexts in which to consider geometry

The first issue was introduced by Adam Vile of South Bank University. He outlined a unit on symmetry that he uses with third year undergraduates on an education course. Using a dynamic geometry package, part of the course involves transforming a hook shape with a selected transformation which is repeatedly applied. The questions the students tackle include: How do you generate different frieze patterns? How do classify the patterns obtained? and so on.

Adam finds that students on the course are incredibly surprised to find that there are only 7 possible classifications of the frieze pattern.

Adam was asked about the student experience and questions were asked about *Acceptance that* ... and also about *Conviction that* ... - there were only 7 ...

The working group went on to discuss how acceptance/conviction links to the mathematical statement that there were only 7 and did the students have the tools (or mathematical resources) to explain why there were only 7.

We noted the classic challenge in the transition from "*I* can't do any more" to "There aren't any more". This involves a fundamental shift of attention and is essential to the nature of mathematics. This is another situation in which the notion of proof appears.

The working group also considered how this connects with the debate about the relationship between algebra and geometry. Dick Tahta suggested some years ago that

"The geometry that can be told, is not geometry, but algebra"

However, in this case, it was argued, it is algebra that is a tool for geometry (rather than geometry being a context in which to introduce algebraic notions).

The working group then moved on to briefly consider contexts in which to consider geometry. A link was made to the work of Paulo Boero (and colleagues) and the notion *of fields of experience* (1995). A sociocultural (Vygotskian) perspective was also mentioned, linking, for instance, to the history of frieze patterns set in a cultural background and including 'everyday' experience. As another example, Boero's work on shadows was mentioned. The link was also made to James Greeno's (1994) ecological metaphor.

Suggested categories for contexts included: natural (as opposed to contrived) and usefulness (although Boero, for instance, claims that usefulness is not as important as many people seem to think).

Boero's (1995) notion *of fields of experience* was returned to because, Boero suggests, it links objects to processes. The extent to which geometry has lots of objects and algebra has lots of processes was explored briefly. Other notions touched on in the discussion included:

- Procepts - objects with processes attached.
- Signs - mainly iconic signs - geometry
  - mainly symbolic signs - algebra

The working group intends to continue the discussion of contexts for geometry at the next meeting in Sheffield on Saturday 24 February 1996.

References

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