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INTRODUCTION: SEMIOTICS, MATHEMATICS AND MATHEMATICS EDUCATION:

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The contributions in this issue are of a number of types. The first few, including this one, are introductory writings about semiotics, mathematics and education intended to perform an orientating function. Then there are, but not in this order, first of all papers concerning symbolism, semiotics, and discourse in research in mathematics education, and secondly papers about the relations between symbols, semiotics, mathematical objects and the nature of mathematics. These two groups are not entirely disjoint. As editor I have presumed to include several of my own contributions which I thought relevant. As reader you will, of course, choose which of these to read, so I make no apology for any excess of zeal in this department!

What has semiotics, with its concerns with the meanings of how people dress, how they exchange and use signs, to do with mathematics education? One answer is that mathematics is the quintessential study of abstract sign systems and the object of study of mathematics education is how persons come to master and use these systems. If, as I believe, both mathematics the discipline and mathematical understanding are socially constructed via endless 'conversations' at the macro and micro levels. So to understand mathematics one must attend to the texts and signs that are exchanged in these conversations. What tools are there to analyse them? The obvious place from which to draw inspiration is semiotics. Another area of interest is the analysis of the discourse of teachers and learners in mathematics classrooms. How are texts, signs and meanings being created, used, negotiated, transformed and assessed? Again, semiotic and related tools offer a conceptual way in. Of course there is no overarching theory of semiotics and variant approaches are inspired by Peirce, Saussure, Barthes, Eco, Halliday, Rotman and others. I am still exploring the theoretical basis and no end is in sight!

Semiotics offers a unique theoretical position that can serve to draw together linguistic, cognitive, philosophical, historical, social, and cultural perspectives for mathematics and mathematics education. This is because it takes the act of signifying, and the full range of communicative activities, as central. It has long been recognised that symbolism plays a unique and privileged role in mathematics. Semiotics provides through a set of pre-defined theoretical frameworks the means to study the signs and symbols of mathematics, with attention to both signifiers and signifieds, and more generally, to all acts of signification.

An important feature is that semiotics is neutral towards representationalism - the assumption that a sign must mirror the world or Mathematical Reality. Semiotics regards signs, symbols and all of language as constitutively public. However, meanings and imagery can be and are appropriated, elaborated and created by individuals and groups as they adopt, develop and invent sign-uses in the contexts of teaching, learning, doing and reflecting on mathematics. Thus semiotics rejects the subjective/objective dichotomy that consigns mathematical knowledge to 'in here' or 'up there'. It provides a liberating perspective from which to study mathematics and education. It opens a new avenue of access to the concepts that have been developed for mathematics education in the social sciences, psychology and the other sciences, but it also allows access to the intellectual resources and methods of the arts and humanities.

Some open questions:

- What can semiotic analysis offer a study of learning mathematics?
- What examples exist of semiotic-based research projects; cameos and findings; methodological issues?
- How can the basic ideas of semiotic analysis be clarified?
- What are the links with and new ways of conceptualising existing work in psychology of learning mathematics, mathematics and language, theories of mathematics and mathematics education afforded by a semiotic perspective?
- Precisely how does (and might) semiotics figure in the social, cultural and contextual studies of learning e.g. in the work of Lave, Vygotsky, Activity Theory, etc.?
- What benefits flow from the fact that semiotic perspectives allow meanings, understanding and mental events to be viewed as not logically prior to the sign but as mutually constitutive?
- What can be revealed about mathematics by studying it as a semiotic system?
- Does semiotics have the potential to offer the basis for a unified theory of mathematics education (and mathematics)?

- What are the central concepts and theories of semiotics?
- How to clarify the ideas of sign, symbol, and accommodate the apparently irreconcilable dyadic conception of sign (e.g. the signifier and signified of de Saussure), and the triadic conception (e.g. subject, object, representamen of Peirce), whilst acknowledging the open-endedness and ambiguity of these notions?
- What are the possible relations between semiotics, literary criticism and discourse analysis, for example as used in interpretative paradigm research in education? How are these useful in mathematics education?
- Can cognitive meanings be fruitfully understood as appropriated cultural meanings of mathematical signs, as indicated in informal mathematical concepts, e.g. addition as grouping? What of the shift in such meanings historically and across the pedagogical sequence (e.g. '+' in N differs significantly from '+' in Z, e.g. "adding makes bigger"?).
- How do semiotic perspectives relate to the body, enactivism, metaphor, etc.?

SYMPOSIA

A Semiotics and Mathematics Education working group meets regularly at the **conferences** of British Society for Research into Learning Mathematics since 1996, co-organised by Paul Ernest and Adam Vile

A Semiotics and Mathematics Education discussion group met at the psychology of mathematics education **conference in Lahti, Finland in** 1997, co-organised by Luis Radford and Adam Vile

WEB SITES

Previous issues of The Philosophy of Mathematics Education Journal and Newsletter can be found at Paul Ernest's web site:

http://www.ex.ac.uk/~PErnest/

The semiotics of mathematics education web-site is run by Adam Vile at:

http://www.scism.sbu.ac.uk/~vileawa

This gives details of the above symposia. Adam can be contacted directly by E-Mail at vileawa@vax.sbu.ac.uk.

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email comments and suggestions
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