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A Social View of Mathematics: Iimplications for Mathematics Education

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Implications for Mathematics Education

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In recent literature one increasingly finds the proposal that we take a more social view of mathematics, but the intention can vary considerably. On the one hand, it can mean a recognition of the social nature of teacher/pupil interaction, and the significance of the social context for mathematics education, perhaps the last school subject to concern itself with anything other than content and the manner of its presentation. On the other hand it can be a recognition of the invasion of the mathematics classroom by controversial issues. In Britain recently, the Prime Minister complained that children in our schools are learning anti-racist mathematics instead of arithmetic. In another instance the conservative press complained about a public examination question that contained several parts asking pupils to read from a graph of arms expenditure by Nato and the Warsaw Pact. It ended with a question concerning the number of weeks of arms expenditure that would be required to feed the starving peoples of the world. It is obvious which part of the question was considered objectionable.

The intention of this paper is to propose that there are distinct consequences of a social view of mathematical knowledge, and to briefly present two examples. In order to do this I will first indicate my use of the notion of a social view of mathematics. I take this to apply to mathematical knowledge itself, in that the history of mathematics is not one of the gradual revelation of absolute truths, but, as with all knowledge, the consequence of people's ideas, interest, conflicts and patronage, and is culturally and temporally relative. Mathematical knowledge is a social construction, the meaning of a concept such as 'polyhedron' for example, following Lakatos, is negotiated and adapted according to convention and agreement, through proofs as explanations, leading to basic refutable statements. It is not the case that there exists, in some universal sense, a concept called 'polyhedron', which merely needs discovery and explication. This equally applies to notions of proof, truth and rigor, by which we justify particular areas of mathematics. Consequently, there is no natural or logical necessity to the state of mathematical knowledge at present. Undoubtedly we have a body of mathematical knowledge, that generally works, but it is in the nature of a library of accumulated experience, rather than universal truths. In any case, the 'it' refers to that collection of books on the shelves of the particular libraries that we frequent. Bishop, D'Ambrosio, Gerdes and others highlight our culturally restricted view of mathematical concepts. I suggest that the consequences of a social view of mathematical knowledge itself are far-reaching, including:

1) that there are alternative mathematical concepts, the direction of mathematical development is not a necessary one;

2) that, since mathematical truths have always been taken as the paradigm of true propositions in philosophy in general, taking this last bastion of certainty as itself relative is quite fundamental to our whole notion of knowledge;

3) that there is a full sociology of knowledge, dealing symmetrically and impartially with 'true' mathematics as well as 'false';

4) that the world 'out there', including the mathematical, is unknowable in any universal a priori sense.

This notion was proposed by the radical constructivists at the last PME conference in Montreal, and it is important to recognize that this is a central problem for philosophy today, as well as for mathematics education.

Taking this alternative view of mathematics, there are many possible consequences, for teaching styles, curriculum development etc., and I have described these elsewhere (Lerman 1983, 1986, 1987). I will develop here just two illustrations of implications for mathematics education, namely political and social education through mathematics, and the notion of ability.

Firstly, I suggest that teachers of mathematics can no longer sit in the school staffroom, believing that values enter every classroom except the mathematics one, and this not simply and solely because of arguments such as that education is everyone's responsibility. Since mathematics is as much a social construction as any other form of knowledge, it is culture-bound and value-laden. A strong case can be made for characterizing mathematical values as sexist, for instance. Further, sociological analyses such as those of Freire, Apple and others propose that knowledge is power, i.e. that different conceptions of knowledge reflect different forms of social relationships and control. Freire, for instance, describes the 'banking concept' of education, whereby students activities are restricted to storing, filing and retrieving, as against the 'problem-posing' concept, whereby people see themselves as owning the mathematics, and empowered to both pose questions and propose solutions. This latter notion resonates strongly with the ideas of Stephen Brown and others in mathematics education.

Mathematics indeed serves a central function as a tool of government and power groups, since it is used to justify all sorts of policies and decisions, including closing coal mines, fighting inflation rather that poverty, under-funding social services and health, and in the Britain disbanding the Inner London Education Authority. Education for a critical mathematics places power in the hands of people to have some control over their own lives, and in particular to have such control. Perhaps we have, in the end, more responsibility that any other school subject, not less, for political and social education.

Secondly, notions of ability in mathematics are dependent on theoretical interpretations of learning and understanding, and are not in themselves fixed, certain and value-free. It is a form of platonism, that 'understanding' is a description of a particular completed mental state, much like the recall of forms known by the immortal soul. However, if concepts are themselves social constructions, determined by their use and consequently negotiable, the notion 'understanding' has a quite different meaning. Generally, we tend to see mathematics as, to quote Hart et al (Hart 1981), a "very difficult" subject, that some people seem able to do, and others not, despite many years of learning mathematics. If mathematics is about certain kinds of interactions with the world around, the application of certain ways of thought, or a particular language game, there is no reason why it should be very difficult. We have all encountered instances of children and adults performing sometimes complex mathematical tasks successfully, and more important comfortably, in everyday life, but failing to repeat those same tasks, achieve the same success, or indeed feel comfortable, in the mathematics classroom. This brings into question in a quite fundamental manner our notions of ability, and demands discussion, rethinking and new directions of research. Clearly, new ways of learning call on new ways of assessment, and interpretation of 'ability'. Such very different directions as those described by, e.g. Cobb (1986), focusing on the child's constructions, which in general examine children's grasp of things taught by the teacher. This latter notion of children's understanding is the focus of much on-going discussion and research, but the point being made here is that the concept 'ability' is related to the concept of 'understanding' with which one is working, and not some absolute concept. If we encourage children's understanding of mathematics through independent work in investigations, and problem-posing, and on computers, through Logo for example, we need different ways to assess their progress. 'Understanding' by these approaches, does not mean the successful application of a learned algorithm, and thus cannot be identified by a traditional pencil and paper test, developed within a Piagetian framework of hierarchies of concepts. Yet we adhere to this mode of assessment of children's mathematical ability.

In conclusion, as long ago as 1972, Rene Thom suggested that "all mathematical pedagogy, even if scarcely coherent, rests on a philosophy of mathematics". This paper is a contribution to an examination of the ways in which alternative philosophies bear fruit in mathematics education.

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