Chapter 2

Philosophical, multicultural and interdisciplinary issues

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Abstract: *School mathematics reflects the wider aspect of mathematics as a cultural activity. From the philosophical point of view, mathematics must be seen as a human activity both done within individual cultures and also standing outside any particular one. From the interdisciplinary point of view, students find their understanding both of mathematics and their other subjects enriched through the history of mathematics. From the cultural point of view, mathematical evolution comes from a sum of many contributions growing from different cultures.*

2.1 Introduction

In the 1980s, mathematics educators and didacticians in many countries felt the need to give a more reliable foundation to educational research through philosophical reflection on the processes involved. What philosophy is suitable for this purpose?

Philosophy must explain mathematical thought not only at the level of research, but also as far as teaching is concerned. It must also explain the development of mathematics in the past: philosophy needs history. But what history is suitable? There is a *history of documents* and a *history of ideas*. The latter needs the former, but didactics and epistemology need the latter. This means that we must avoid the identification of philosophy of mathematics with mathematical logic. Our philosophy must guide and explain educational choices; it must help in a better planning of teaching. It must be open to new reflections. In this sense it could be considered as being almost equivalent to epistemology (Speranza and Grugnetti 1996).

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A cultural perspective on mathematics makes us attend to mathematical histories and to what they tell us about who developed mathematical ideas in different societies (Bishop 1995). Multicultural aspects and interdisciplinary issues become therefore part of epistemological reflections about mathematics education; the relationships between philosophical, multicultural and interdisciplinary issues are very strong. Moreover, the history of mathematics as the history of ideas is strictly linked to (or better, is part of) the history of human beings. In this view we have to analyse the cultural, political, social, economic contexts in which ideas arose

2.2 Philosophical issues

2.2.1 Historical investigation, evidence and interpretation

Differing views on the nature of historical enquiry

The widely held view of mathematics as a pure subject uninfluenced by outside forces is slowly changing, and this is reflected in the changes in the approach to more general historical study. If we agree that history is that branch of knowledge which caters for society's needs to understand particular aspects of the human past, then we express our needs by demanding answers to a range of who? what? when? how? and why? questions. However, as soon as we start to investigate, we find that these questions are not at all easy to answer. Traditionally, history is viewed as a study of carefully delimited aspects of the past employing systematic research in all available sources. The approach can be from a social, political or economic point of view, and necessarily employs a general philosophy (for example, structuralism, Marxism, etc.) in its interpretation. More recently, 'post-modern' history is seen as a set of processes and power relations linking the past to the present, where the interpretations of events and facts are critically interrogated, the underlying assumptions are revealed, the status of texts are called into question, and where groups of people and their conditions are defined and redefined by those in power.

In a similar manner, there have been changes in the way history of mathematics is undertaken. 'Internalist' history of mathematics is recognised by its tendency to see mathematics as a subject isolated from 'external' influences and as a progression of ideas which are improving and becoming more abstract and general with time. In the internalist, sometimes called 'whiggish', account the events of the past are seen as instances of steps towards the present more perfect structures. This kind of history tends to interpret the past in terms of modern concepts. More recently, researchers have tried to take a more holistic view, with mathematics seen as a component of the contemporary culture; the historian's task is then to discover the influences, conditions and motivations (social, economic and political as well as scientific and mathematical) under which problems arose. Admitting these points of view necessarily leads to much reinterpretation of the received wisdom of earlier writers. In the past, most research in the history of mathematics has been carried out by those with mathematical training. In consequence, the interpretation and its

writing up has not only utilised technical language, but has tended to employ a narrative which maintains the genre of the hypothetical-deductive style employed in mathematics itself. In this way it has given the impression of an authoritative account of the events in question, where often the historical subject can be criticised for making errors, pursuing a fruitless avenue of enquiry, or not seeing a solution which later seemed obvious.

Historians, on the other hand, realise that there are many different sorts of questions about the past, giving rise to many different sorts of history. The events, structures and processes of the past are known only through the relics and traces of the past, which are themselves politically and conceptually loaded and imperfect. There are difficulties of understanding archaic languages, contemporary technical terms, and the special 'codes' within the available sources, so that any interpretation is cautious and aware that many concepts may carry with them a collection of unsubstantiated assumptions. In perceiving relationships between different events and conditions the historian may have to consider theories derived, for example, from economics, psychology, sociology or anthropology. Furthermore, the account is constrained by conventions of language, genre, mode, argument, and a number of other cultural and social contextual conventions. In this perception theory, sources, and style interact in an iterative way.

Facts and events

The notion of a 'fact' is ambiguous, since it includes the sense of both *event* (meaning whether or not the event took place), and *a statement about an event* (where the concern is with the truth or falsity of an occurrence or statement). In this sense, facts are constructed in the documents which refer to the occurrence of the events, not only by interested parties (contemporary or more recent) commenting on the events or the documents, but also by historians giving what they believe is a true account of what really happened in the past. Therefore it is the facts that are subject to revision and further interpretation, and they can even be dismissed given sufficient reasons.

This view allows us to account for the fact that historiographical consensus about any event is very difficult to achieve. It is always open to revision from another perspective. We not only change our ideas of what the facts of a given matter are, but our notions of what a fact might be, how facts are constructed, and what criteria should be used to assess the adequacy of a given collection of facts in relation to the events which they claim to support. The relation between facts and events is always open to negotiation and re-conceptualisation not because events change with time, but because we change our ways of conceptualising them.

This argument leads to a position of historical relativism in which the truth and authoritativeness of a given account of the past must be assessed in relation to the cultural context and social conditions prevailing at the time, and with respect to the perspective of the current interpretation. As noted above, the interpreter's viewpoint is also involved. The problem is that this position appears to deny a secure and timeless epistemological foundation for history, which still causes concern to some historians. However, it must be recognised that a particular historical investigation in its final written form does not represent a totally authoritative statement or a

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