

Confronting Fear and Prejudice in Math and Science

Philosopher sur les mathématiques et les sciences

Les aventures mathématiques de Mathilde et David;

Rencontre avec le monde des sciences;

Marie-France Daniel, Louise Lafortune,

Richard Pallascio, Pierre Sykes Quebec: Le Loup de Gouttiere, 1996.

reviewed by Mary Tiles

Is there a way to overcome the fears and prejudices that create obstacles in the minds of children when it comes to studying mathematics and science? The fears are that these disciplines are difficult, boring and useless because they bear no relation to everyday life. The prejudices include the idea that those who are good at such things are peculiar in some way, and the perception that these disciplines are male preserves, that girls will never be any good at them. These texts, aimed at 9 to 13-year-olds and their teachers, address these issues head on and by encouraging children themselves to discuss and confront their fears and prejudices, hope to help overcome them. Although important, this is, of course, not the sole aim of these texts which are more generally concerned to open up mathematics and the sciences to children.

The approach used is an extension of that developed by Matthew Lipman and Ann Margaret Sharp in their Philosophy for Children program. Two of the texts, *Les aventures mathématiques de Mathilde et David* and *Rencontre avec le monde des sciences*, are short novels designed to be read in class, with the children taking turns to read a few sentences out loud. The stories portray 9 to 13-year-old children in their school and home settings as they engage in mathematics and science classes and as they discuss mathematics and their attitudes toward it amongst themselves. The stories are written so that each chapter should prompt a number of questions from the children on themes which the teacher can anticipate in advance. The third text is for teachers. It contains discussion plans, activities and exercises organized around concepts or themes occurring in the novels. These are arranged alphabetically.

The anticipated use of these texts follows the general format used in the Philosophy for Children program. After reading a chapter the children are asked to spend some time reflecting quietly on their own about what they have read, in order to formulate questions. They are then brought together and their questions are listed, together with a record of who asked which question. Children already familiar with the procedure will know that questions must be relevant to the material of the chapter and that if they do not seem relevant they may be challenged to explain why they asked the question. Once the questions are recorded, the class decides which to pursue further in discussion and the teacher may follow up with related activities or exercises. The concept governing this way of proceeding, derived from John Dewey, is that of a community of inquiry. This in turn derives its inspiration from the idea of Socratic dialogue, as portrayed by Plato. The primary epistemological principle underlying this pedagogical approach is that in order to arrive at knowledge (in the form of understanding) each person needs first to make sense of the material to be known. Further it is argued that people never embark on the project of making sense for themselves without first passing through a stage of questioning, of putting in doubt. In other words, knowledge is not simply what can be taken for granted, it is what has been reaffirmed after questioning and what, consequently, can be supplied with a justification for belief, a justification which responds to sceptical questions.

Because this philosophy underlies the whole Philosophy for Children program, that program has obvious implications for the study of other academic disciplines and for mathematics and the sciences in particular. It is also in these areas where its pedagogical implications are perhaps most significant, since these disciplines have frequently suffered from the image of being bodies of facts to be transmitted from teacher to pupils who learn them by rote. It is this image of masses of facts to be memorised which contributes heavily to the perception that mathematics and the sciences are boring and burdensome. It is the fact that they also involve problem solving, and that creative problem solving on the basis of rote learning is next to impossible, that makes them seem so difficult. Moves, such as those illustrated in the texts under review, to extend the pedagogy of the Philosophy for Children program in the direction of mathematics and science are thus very promising.

The Philosophy for Children program itself has come under criticism from some quarters for not really being philosophy. It does not after all aim to teach the views of great philosophers or to engage in heavy duty philosophical theorizing. It does however aim to get children thinking reflectively about things that they do and about questions which concern them and does aim to provide them with the intellectual tools to do so. In this very practical and actively engaged sense it is getting children to think philosophically, but not to study philosophy. Regardless of the name, because the activities required of the children, disciplined discussion, attention to reasoning, justification, listening to the points of view and criticisms of others, are those crucial to the formation of the kind of critical rational abilities that philosophers have always regarded as being central to science, it would seem to be a natural starting point for moving into mathematics and the sciences.

Les aventures mathématique de Mathilde et David certainly provides ample scope for addressing questions of attitudes toward mathematics, the supposed contrast between mathematics and creative

subjects, such as art, the perceptions that it is difficult and or boring, and the problematic relation of girls to the subject as well as the attitude of boys to girls who are good at science and math. Mathilde is good at and interested in math, whereas her twin brother David is not. He, on the other hand, excels at art. In the course of discussions prompted by what goes on in class, Mathilde, David and their friends touch on topics such as the nature of proof, the nature of infinity, the difference between numbers and numerals, whether geometry is part of mathematics, the abstractness of mathematical objects, the eternity of mathematical truths and the kind of learning required to succeed in mathematics. The teacher materials provide excellent support for following up on such topics with discussion or related activities designed to prompt further thought about them. This looks as if it would be well worth trying out in more schools especially those with already established Philosophy for Children programs.

However, the topics mentioned above are all recognizably philosopher's topics, and while they may well stimulate children to think more reflectively about mathematics, it is not clear that they will do much to lead them into a more fruitful engagement with the subject itself. In the novel there is no portrayal of any real involvement with a mathematical problem, and hence no real opportunity provided to grapple in a very significant way with problem solving and the differences between rote learning and the kind of learning and thinking required for problem solving. Perhaps this would have been too much to ask in the scope of one novel, and perhaps it merely points the need for a sequel. Another sequel, or avenue not explored in this material, would be that of multicultural mathematics. The story actually contains the basis for introducing this theme, but not a basis for its further exploration. One of David's classmates, Ramon, is a Mexican immigrant, also struggling with mathematics. The question of how mathematics has been done in different cultures is one which would seem very amenable to the kind of approach adopted here and one which would start to take one further into the subject matter of mathematics itself as well as grounding more philosophical reflection on the nature of the subject.

*If *Les aventures mathématique de Mathilde et David* seems somewhat slanted toward philosopher's questions about mathematics, *Rencontre avec les sciences* seems almost entirely to ignore philosopher's questions about science, with the exception of the problem of induction. In this story there are episodes from everyday life which seem designed to prompt discussions of technology. But technology is not science and the sciences themselves, with the possible exception of the theory of evolution and the biology of reproduction, make few appearances in this story. Did the authors think that science itself is not approachable by 9 to 13-year-olds? They certainly seem less concerned to dispel myths and popular misconceptions of science than of mathematics. Whereas a clear focus and sense of purpose is discernible in *Les aventures mathématiques*, this is less apparent, at least to this reader, in *Rencontre avec les sciences*. That is not to say that children might not benefit from discussions prompted by the material: they surely could: one of the nice features of this pedagogical approach is that the teacher and pupils are not constrained by the actual content of the material. But I do not really see this story as providing an easy route either to opening up the world of science to children or to reflection on the nature of any of the sciences. Again there is no portrayal of children engaged in problem solving, carrying out a practical project or confronting a situation in which it might be necessary to design and run an experiment. The project on which they are*

engaged, in the fictional setting, is that of having an astronaut visit the school. This seems to be playing into media generated myths about science rather than seeking to foster any critical attitude toward them.

All in all, these texts represent a very promising development. It is relatively easy for others to come along with criticisms, especially concerning what might have been done but was not. It is much harder to actually produce usable materials. These materials do look very usable and should really be tested in a classroom before critical comments are given any credence. Although we are planning to try to do this in some schools in Hawaii, we have not yet had the opportunity to do so, in part because *of* the prior need to translate material into English. In thinking about conducting such experiments in the very different cultural context of schools in Hawaii it is, however, also clear that because the stories try to reflect the everyday lives of the students at whom they are aimed, considerable modification is required to reflect cultural contexts other than those of Quebec. Nevertheless, it seems to us that it would definitely be worth the effort to undertake translation on both levels.

Address correspondence to:

Mary Tiles

Department of Philosophy

University of Hawaii at Manoa

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