

## **EDITORIAL**

### *Scientific Thinking, Mathematical Thinking, Historical Thinking, and Thinking Well About the Present and the Future*

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It is only a little over a century ago that teachers in the English speaking world took the paradigm of knowledge to be, besides arithmetic and geometry, knowledge of the Latin and Greek classics. Of course they may not have actually taught very much, or for that matter any of these. But the background of what a good education ought to consist was largely of these things. Due mainly to the influence of the Quakers in Britain and to a lesser degree in the United States, schools that offered a *modern* curriculum came to be, at least in Quaker schools. Such a curriculum maintained the emphasis on arithmetic and geometry and algebra and at the later levels began the infinitesimal calculus. But instead of emphasizing Latin and Greek it emphasized the importance of knowledge of modern national science, mainly physics, chemistry, and biology. It also considered that modern languages were important and often this meant French, German, and Italian. One could pass pretty easily between a Quaker school of the mid-19<sup>th</sup> century and a school today in most jurisdictions. Only rarely in some private schools in the United States, in some public high schools, the Collegiate Institutes in Ontario in Canada and in many so-called public schools in England can one find the emphasis of the old classical curriculum still mainly intact or at least present.

A teacher in the elementary schools of the United States, Canada, and Britain, at least since the Second World War, would be expected to think of themselves in possession of certain scientifically sound teaching methods and a certain amount of definite scientific knowledge as an absolute necessity. It was largely unspoken that ours was a scientific and modern age and science and modern languages were seen as important and probably crucial for the future life of the children under our care and for the future of our life on this planet and beyond. Had a

teacher been pressed she or he might have answered to the question "What is most important that you impart to your pupils?" she or he might have replied that it was the scientific attitude to knowledge, as well as such facts and methods necessary for them to acquire this attitude as a habit of mind.

We are still in the midst of the greatest scientific age our species has ever seen, an age in which our main human successes are related to the advance of natural science and our natural scientific knowledge, especially the tiny fraction of that knowledge that lends itself to technological development. But we are also for the first time in an age in which we can also see the dark side of the technological spin off of that knowledge without further thinking about the long term consequences for ourselves, for the other animals and plants on our planet Earth, and for the very planet itself. This suggests that while the scientific attitude to knowledge is still a priceless possession and the Quaker curriculum still tremendously important, there are other things a teacher might hope to pass on to the children under her or his care and trust. But what, exactly, are these?

One of the things we have learned in the course of the last 100 to 150 years is that it is much more important to convey a style of thinking than merely to convey a body of memorized techniques or a body of memorized facts. Thus we now try, with unfortunately less than satisfactory results as a rule, to convey that mathematics at all levels is more about thinking about order in a certain way rather than merely getting correct results to type questions of a kind for which the answers have been known for hundreds, perhaps thousands, of years. And we now try to convey the kinds of thinking and hard work necessary for the production of serious history, for convincing and reliable stories of the past thoughts and actions of human beings, rather than merely have our pupils memorize the names of past monarchs, prime ministers, or presidents or of past wars and war heroes. These are genuine advances and are related to, but not identical with, the kind of thinking of the scientific kind necessary to interrogate nature.

There is a sense in which both our mathematical thinking and our historical thinking are about the interrogation of ourselves, the interrogation of mankind. Mathematical thinking is about thinking well about our own creations, the kinds of things we make up that have order. In some respects it is to be assimilated to the kind of thinking we might want to encourage in an art class or in a poetry or creative writing class. It has the logical order we require for our interrogation of nature

but does not suffer from the constraint that nature imposes on that thinking, namely, that it must conform to the facts of the world as we actually find them.

Historical thinking does have constraints too, some of which overlap with those that affect the interrogation of nature. But it also has the interesting oddity that it must refer to the documentary or archaeological or other remnants of the past thoughts and actions of our species. It also requires that we know a lot already about past human thinking and action and that we have insight into the way that human beings approach the problems and questions they face or have already faced. Unlike the interrogation of nature, in which we can ask the same question of nature here, there, and anywhere in either time or space and expect to get exactly the same answer or something has gone wrong, the historical interrogation of ourselves, of our past thoughts or our past actions, can only be asked about one moment in time and at one location. The documents we have cannot be multiplied at will as those we might generate in an inquiry into some aspect of the natural order. In engaging in genuine historical thinking we are centrally engaged in questions that relate to human decisions, both individual and collective. We are concerned with the impact of previous human thought on the thought of a particular human being at a particular time and place in a particular context. Thus we are engaged in training for thinking well about human actions not only of the past but also of the present and even, one might suggest, about the future.

Thinking well about the present and anticipating adequately the future are the most difficult kinds of practical thinking that we human beings all must do. While it is not clear that thinking well about the historical interrogations of ourselves is sufficient training for what we need in this regards it is certainly a good beginning. It may not be sufficient but it is probably necessary. In the papers that follow in this special issue and a following one devoted to what it is for a teacher to live well in the context of their educational task in the contemporary world it might be noticed that pretty well every writer is, in fact, advocating a kind of development of the powers of historical thinking so that we might handle the present and an anticipated future better. This kind of thinking is not traditional scientific thinking, though it may appear to presuppose it, just as historical thinking may appear to. But it is equally plausible, I think, to suggest that historical thinking underlies both successful attempts to think well about our own times and about our anticipated future and also the possibility of scientific

thinking too. Indeed, one might argue that good mathematical thinking, just as good artistic thought, presupposes good historical thinking. Why this is so I shall leave as a puzzle for the reader to work out her or himself, though I will develop this theme in a future editorial.

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