Theme editorial

Epistemic insight: teaching and learning about the nature of science in real-world and multidisciplinary arenas

Berry Billingsley and Mark Hardman, Special Issue Editors

It is with great pleasure that we invite you to discover and read this special issue of *School Science Review* on the theme of epistemic insight.

There is a vast body of research that looks at how students describe science and also at their ideas about what types of people work in science. The point of much of this research is to cast light on the unintended consequences of how we teach. So, for example, if students' experience of practical work is largely made up of 'recipe' investigations, the message from research is that some of them start to suppose that this is how science proceeds and that every question can be addressed and resolved in about 20 minutes with an experiment.

Epistemic insight is a term we are using to research and discuss students' perceptions of the nature of science – but we have chosen the term strategically. We say that epistemic insight refers to 'knowledge about knowledge' and particularly to students' scholarly expertise and their capacity to be wise about how knowledge is and can be formed and tested.

The rationale for using this broader term rather than the narrower term 'nature of science' is that students are generalists for most of their time in school. For them to get a deeper understanding of science as a discipline, it would arguably help if their teachers discussed with them how science compares and situates in that wider multidisciplinary mix.

There is no call here to do away with the teaching of disciplines and to instead teach students about a series of cross-curricular topics; rather, this is a call to use the spread of subjects and outside opportunities available to effectively communicate to students the nature of science, and what it means to work in science and science-related

careers. Indeed, if the current science curriculum is critiqued with this in mind, many of the curriculum objectives that point to this kind of focus already exist but currently they are interpreted and taught through a relatively narrow frame. For example, it would arguably be helpful for students to have a session on evidence in which a history teacher and a science teacher collaborated in a discussion of what each of their disciplines means by evidence. The session could begin by asking students to consider how science and history could each respond to the question 'Why did the Titanic sink?'

With this in mind, we are creating an international research and education initiative, called Epistemic Insight, which aims to identify and foster strategies that can raise students' appreciation of the nature of science in a broader academic and real-world frame. This special issue of *School Science Review* is one step on that journey. We intend to have a follow-up issue in the near future and would be delighted to hear from readers wanting to respond to the articles here or contribute new directions for research around this theme.

We start the articles in this special issue with a more detailed introduction to the rationale and significance of the Epistemic Insight initiative by Berry Billingsley.

Peter Fensham, from Monash University in Melbourne, follows this by mapping curriculum changes since the 1960s and outlining school and teacher responses to these. By linking curriculum change to the changing needs of society, Peter sets the context for developing scientific literacy.

William McComas, from the University of Arkansas, then lays out the understandings and misunderstandings around what the nature of science is and the form it takes when presented to students. Following this, Haira Gandolfi draws on her doctoral studies at the UCL Institute of

Education, London, to describe how teachers embed the nature of science within their teaching, which offers food for thought to science teachers.

Ian Abrahams, from the University of Lincoln, and colleagues take a different view and put forward the bold argument that a functional level of scientific literacy could be taught to students by the time they are 14 years old, meaning that later study could be focused on those who choose to pursue science further.

After the first four articles set the context and pose challenges around epistemic insight, Mark Hardman presents the first of two articles considering the importance of models in doing, learning and teaching science. He argues that models may be framed

as explanations of the world, and that this framing allows students to understand much of the nature and limitations of science. David Hay, from King's College London, then eloquently shows the other side of this coin, using the narrative of a young girl finding a beetle to explore how models can emerge from interaction with the world.

Vicky Wong, also from King's College London, then describes the difficulties that students have in recognising how graphs are presented differently in mathematics and science. Her article calls on science teachers to support students in understanding these disciplinary differences, which her article makes clear.

The final two articles of the special issue consider how students from all backgrounds can be engaged in science. Many readers may be familiar with the work of Becky Parker and the Institute for Research in Schools (IRIS), which supports students engaging with genuine scientific problems. Becky's article describes how and why this is beneficial to students and the scientific community. Readers might equally have heard of the concept of 'science capital', which reflects the science-related resources and dispositions that students have. Effrosyni Nomikou, Louise Archer and Heather King share strategies for building science capital in the classroom.

Together, the articles presented here promote the need for embedding epistemic insight into the teaching of science, and provide a range of ways that students could be supported in better understanding what science is and why they might engage in science themselves.

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